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USER'S MANUAL FOR THE COMPUTERIZED ELECTRONIC SYSTEM COST MODEL

TECHNICAL DOCUMENTARY REPORT NO. ESD-TDR-63-446

OCTOBER 1964

T. J. Jannsen
H. Glazer
J. C. Des Roches

Prepared for

DEPUTY FOR ADVANCED PLANNING
ELECTRONIC SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
L. G. Hanscom Field, Bedford, Massachusetts

Project No. 850.0

Prepared by

THE MITRE CORPORATION
Bedford, Massachusetts
Contract AF19(628)-2390

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FOREWORD

The authors wish to acknowledge the assistance of Miss Elaine Morse, who prepared the exhibits and several of the tables. In addition, she made valuable contributions to the paper, especially in Section 4.

ABSTRACT

The Economic Factors Department of MITRE has developed a computerized electronic system cost model as part of its work in system cost methodology. This document describes the initial version of the model and gives instructions for the electronic data processing procedures, including presentation of the key punch input forms, computer output formats, and a description of the computer program logic. The model, currently operational, has been programmed for the IBM 7090 computer and requires a 32,768 register core memory.

The objectives of this manual are to provide a Primer for the cost analyst, and a Reference Manual for the detailed operations on the use of the model.

REVIEW AND APPROVAL

Publication of this technical documentary report does not constitute Air Force approval of the reports findings or conclusions. It is published only for the exchange and stimulation of ideas.

FRANCIS J. HOERMANN
COLONEL, USAF
COMPTROLLER

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USER'S MANUAL
FOR THE
COMPUTERIZED ELECTRONIC SYSTEM COST MODEL

1.0 INTRODUCTION

1.1 Purpose of User's Manual

The Economic Factors Department of MITRE has developed a computerized electronic system cost model as part of its work in system cost methodology. This document describes the initial version of the model and gives instructions for the electronic data processing procedures, including presentation of the key punch input forms, computer output formats, and a description of the computer program logic. The model, currently operational, has been programmed for the IBM 7090 computer, and requires a 32,768 register core memory.

This report has been organized to accomplish the following objectives:

1) Provide to management a general description of the computerized model including its capabilities and features;

2) Provide to system cost analysts a primer on how to use the model;

3) Provide a reference manual which details the procedures to follow in preparing and checking input data for the model, and in using the model efficiently; and

4) Provide to computer programmers a general description of the programming logic and program specification of the model.

Sections 1.2 and 1.3 describe the system costing process in order to put the model in its proper context. Included is a brief discussion of the generalized concept of a cost model and its uses. Although it is assumed that the reader has a general knowledge of system cost methodology, a selected collection of relevant books and memoranda on system cost analysis and the electronic system cost model are listed in the bibliography. Section 2.0 describes in more detail the computerized cost model which has been developed. Section 3.0 provides the cost analyst with the information necessary to utilize the model and may be considered as the model primer. Section 4.0 is the reference manual which describes the types of cards used with the model, the organization of the cards for processing, the tape used in table generation, the utilization of cost estimating relationships, the means of modifying the cost structure, and the various types of error checks which should be performed. Section 5.0 describes the computer programs and presents the program flow charts.

Sample input forms and output tables are presented in the Appendix, along with other tables and exhibits which will aid the user in obtaining his particular system cost estimate.

1.2 System Costing Process

The system costing process may be subdivided into the following steps:

a.) Development of Cost Estimating Structure

The cost structure is fundamental to consistent system costing. It should reflect the properties of the type of system being costed; also, the structure should be resource-oriented to facilitate costing the resources allocated to the system.*
Since a system may be defined as a collection of subsystems integrated to perform specific functions, the major cost classifications, i.e., categories, of the electronic system cost estimating structure are the subsystems usually identified with electronic systems: viz, hardware (data processing, data presentation, communications, data acquisition and aerospace vehicles), computer programs, personnel, and facilities and support. An additional category, general system, identifies the costs of overall system design, system integration and testing, and system management.

b.) Description of System to be Costed

One requisite for system costing is a description of the system. The relevant data in such a description are those which identify the events in the system life-cycle and the states of the system and its environment which have an impact on the cost of the system. Such data can be classified into four major categories:

Configuration - types and quantities of equipment, personnel, facilities, etc.

Performance Characteristics - equipment reliability and maintainability, data processing speeds, communications error rates, etc.

Operational Concepts - activity rates, employment, deployment, operating environment, etc.

Implementation Concepts - development, procurement and test schedules, technological state-of-the-art, etc.

c.) Application of Cost Estimating Relationships

Cost estimating relationships (CERs) are functions used to compute costs from variables such as number and type of personnel, equipment

*The lines of Table S1S in Appendix A, Exhibit 2, are an example of a structure for electronic systems.

performance characteristics, etc. These CERs, developed by statistical analysis, establish relationships among system variables, resources and dollars. CERs usually permit the calculation of costs in a simpler fashion than by other methods. If CERs do not exist for the particular system elements under consideration, or if the existing CERs are not adequate for the purpose of the estimate for any reason, such element costs may be estimated directly by obtaining, for example, cost data from industry.

d.) Organization of Data for Users

The outputs of system cost estimating need to be organized to meet the needs of the users. At different points in the life cycle of a system, different types of decisions to be made by various users require different types of estimates both in level of aggregation and in categorization of information. One must, therefore, be fully aware of the purposes of the cost estimate to be prepared and should organize the data in formats most useful for such purposes.

1.3 Cost Model and Uses

The steps in the system costing process discussed in Section 1.2 are inherent in the generalized concept of any cost model, as illustrated in Fig. 1. The first step, "Development of Cost Estimating Structure," is shown as "Structure" in the center box. Once a structure has been developed, it may be used for costing many systems, with little or no modification required to reflect the properties of the particular system being costed. The second, "Description of System to be Costed" is represented by the arrow coming from "Relevant Events and States" in the real world, and is input to the model as relevant system information which is converted to dollar costs. This conversion to dollar costs is performed by "Application of Cost Estimating Relationships," shown by the arrow going from "Cost Estimating Relationships" into the center box. The CERs are a subset of the totality of CERs currently available. The arrow leading from the globe, which represents the real world, to "Cost Estimating Relationships" indicates the continuing effort to develop additional CERs and to improve the set of CERs available in the data base. The fourth element, "Organize Data for Users," is depicted by the arrow leading from the center box to "Cost Output," and represents the cost outputs organized appropriately for the user.

The computerized cost model provides time-phased estimates of system costs. These costs may be organized into the three output cost categories -- RDT&E (Research, Development, Test, and Evaluation), Initial Investment, and Operations -- the Air Force budget codes, or both. For systems in the advanced planning stage, this model provides the estimates rapidly and thereby allows consideration of many more alternative approaches than would be feasible if the calculations were performed manually.

The computerized model also provides the multiple outputs required for a cost sensitivity analysis of systems in the design stage. This type of analysis is usually performed to determine the relative changes in total system cost obtained when different values are assigned to selected parameters.

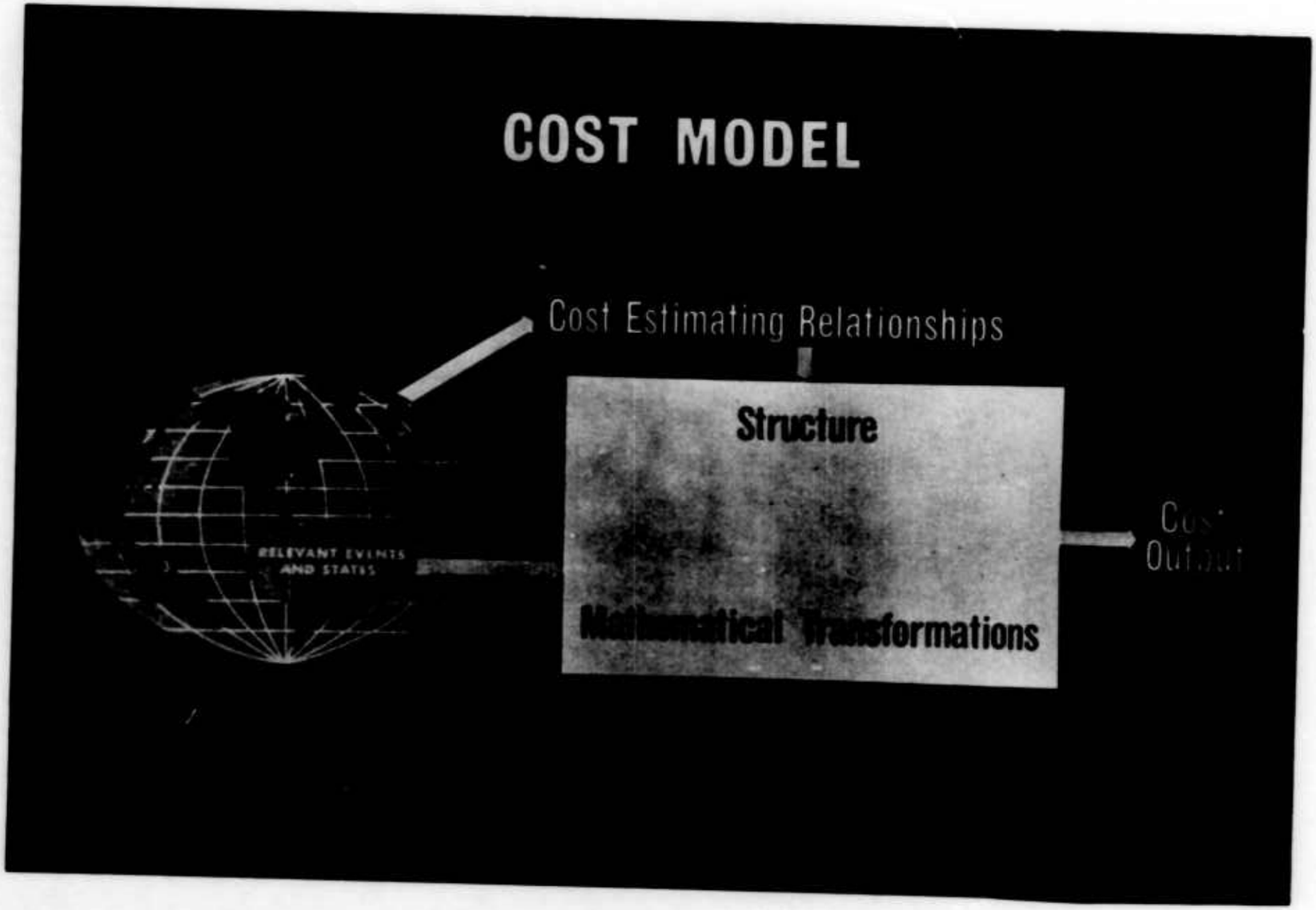
COST MODEL
Cost Estimating Relationships
Structure
Mathematical Transformations
RELEVANT EVENTS AND STATES

FIGURE 1

2.0 DESCRIPTION OF COMPUTERIZED COST MODEL

In the computerized cost model, the cost element estimates are converted to dollars, stored in the structure, and organized into output tables by computer programs. A graphic representation of the model is given in Fig. 2. Operational features of the model are a multi-pass capability and the sensitivity analysis feature.

The inputs to the computerized cost model are direct or indirect estimates of cost elements of the cost structure, data tables which contain values and parameters for CERs, table nomenclature, information on tables desired, and the changes to cost factors or input cost element estimates for sensitivity analysis. Although the system description is indicated as an input on Fig. 2, it is not used directly in the calculation of system costs but is useful in identifying the system being costed.

A set of computer programs has been written which processes these data. Executive programs control the flow of data and calculations. The CER subroutines have been organized to permit expansion of existing CERs and incorporation of new CERs as they are developed. Standard table subroutines for generating tables described in Section 2.5 have been programmed. A capability also exists to develop tables different from the standard formats.

The outputs from the computerized model are the desired tables and a detailed listing of the cost structure. This latter listing is useful for additional analysis and for CER development.

2.1 Cost Estimating Structure

The cost estimating structure is the master table in which direct dollar estimates and computed dollar costs are stored. The detailed entries in the structure for any particular system analysis depend on the system costed; some elements of the structure may be deleted, while new elements may be included, under the control of the analyst making the cost estimate. Hence, only a listing of the major elements within each category in the structure is given below. Jones (Ref. 5) defines in more detail the resources and activities which are included within the system cost elements.

The organization of the structure by major classifications is presented in Fig. 3.

The detailed elements of the structure are presented on pages 86 to 95 of Exhibit 2 in the Appendix.

The major cost elements associated with the General System subsystem are:

a. System Design
b. System Integration, Test, and Evaluation
c. System Management

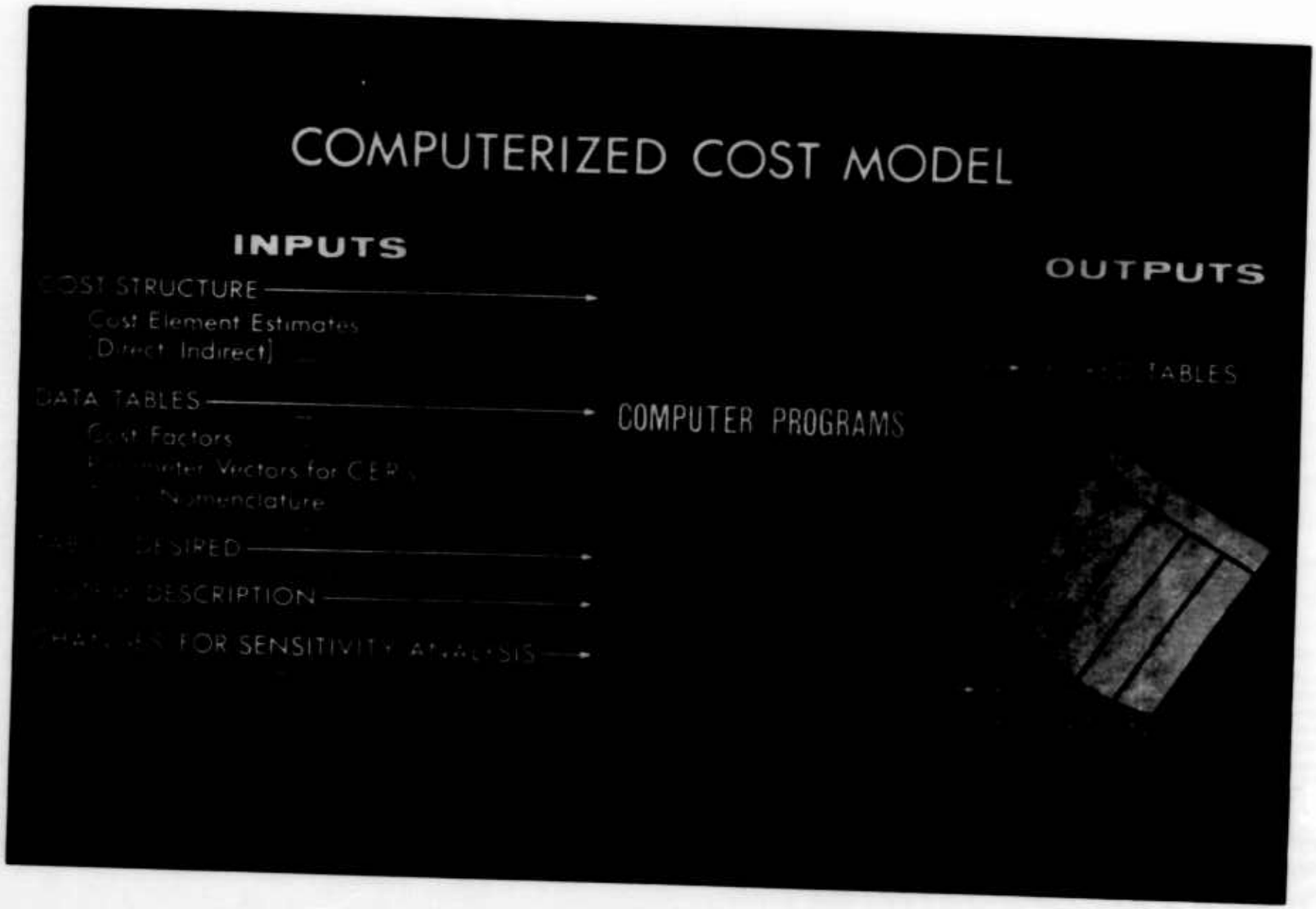
COMPUTERIZED COST MODEL
INPUTS
OUTPUTS
COST STRUCTURE
Cost Element Estimates
(Direct, Indirect)
DATA TABLES
Cost Factors
Nomenclature
DESIRED
DESCRIPTION
FOR SENSITIVITY ANALYSIS
COMPUTER PROGRAMS
TABLES

FIGURE 2

COST ESTIMATING STRUCTURE

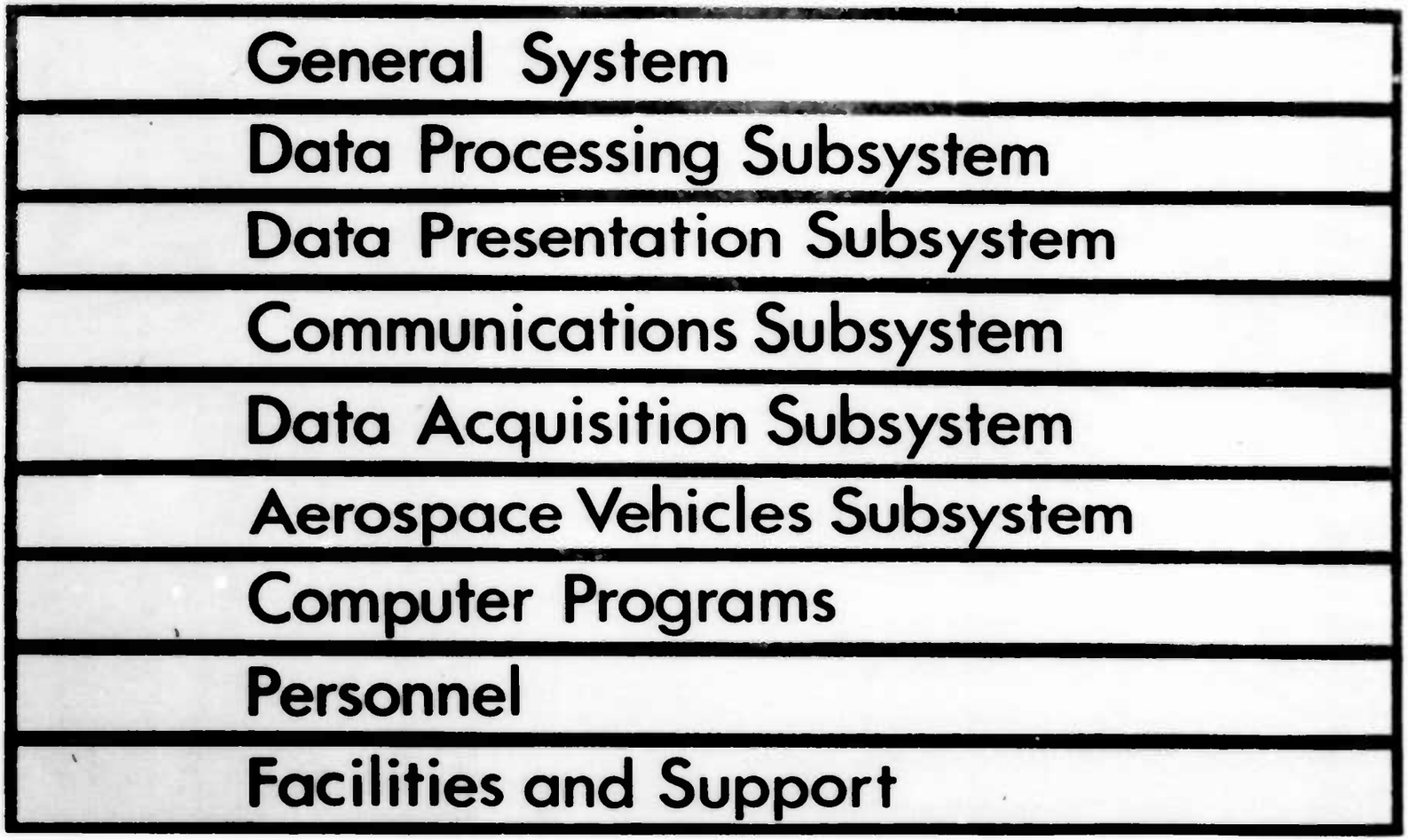

FIGURE 3

The major cost elements associated with the five hardware subsystems are all identical:

a. Mission Equipment
b. Aerospace Ground Equipment (AGE)
c. Replacement, Maintenance, and Rentals

The cost elements of the Computer Programs subsystem have been developed analogously to those for the hardware subsystems. The major cost elements are:

a. Mission Programs
b. Utility and Maintenance Programs
c. Program Maintenance and Operational Exercises

The major cost elements within the Personnel subsystem are:

a. Operational Personnel: Development and Training
b. Equipment Maintenance and Support Personnel: Development and Training
c. Personnel Operations

The major cost elements associated with the Facilities and Support subsystem are:

a. Operational and Support Facilities
b. Initial Stocks
c. Organizational Equipment
d. Facilities Maintenance and Operation

2.2 Cost Estimating Relationships

A set of cost estimating relationships (CERs) is maintained as an integral part of the cost model. The formal documentation of each CER, which is external to the model, constitutes a portion of the data base for electronic system costing.* The organization and codification of the CER set within the model parallels that of the data base itself, thus facilitating use and interpretation of CERs. Similarly, the CER set in the model is updated and expanded in parallel with data base updating and expansion. Such updating is in addition to the ad hoc modifications to the CER set that one may make in any particular study.

The CERs are stored in the computer as addressable subroutines. They have single or multiple inputs, including, in some cases, costs computed by the model. The locations of the inputs within the computer memory are given

---

* Morris, Reference 6.

by a parameter table. The values of the factors and percentages used in CER calculations are contained in a cost factor table.

The more frequently occurring types of CERs are shown in Fig. 4. A detailed description of each CER is given in Section 3.2.

2.3 System Description

Data forms are being developed which describe the subsystems of the system with respect to configuration, performance, operational concepts, and implementation concepts. In later versions of the computerized model, it is expected to modify the input cost element estimate sheets so that time-phased costs may be computed directly from the system description.

2.4 Input Cost Element Estimates

For each element in the Cost Estimating Structure as applicable to the system under consideration (see Section 2.1) an analyst may estimate costs either (1) directly in terms of a dollar estimate, or (2) in terms of the physical resources needed or other indirect parameters, specifying CERs to convert such parameters to a dollar equivalent. Such inputs are specified by fiscal year intervals covering a future period of up to ten years plus a total for years prior to the ten-year period. The total for prior years may be stated in terms of dollars while, at the same time, future year costs may be stated in terms of resources or other parameters. Exhibit 1 contains the input data formats to be used by the analyst.

Flexibility is provided in choosing the level of aggregation at which costs are estimated, since any one of several levels of aggregation is possible. For example, exploratory or feasibility studies associated with specifying system requirements and system analysis during the advanced planning stage of a system's life cycle require less detail (and less is available) than is needed (or available) in the system design or system acquisition stages. Consequently, in the earlier stages, one generally prefers to estimate costs in more general terms, i. e., at high levels of aggregation, while in the design or acquisition stages, one generally makes use of more detailed information available. Moreover, for a particular analysis, some costs may be specified in detail and others in more general terms.

2.5 Output Tables

The organization of data into output tables is determined by the expected uses of the cost model, as discussed in Section 1.3. Because the outputs may be used for different purposes and because different levels and types of aggregation may be required, it is desirable to be able to select from a variety of output formats. A major feature of the computerized cost model is its ability to generate different output formats with various levels of detail.

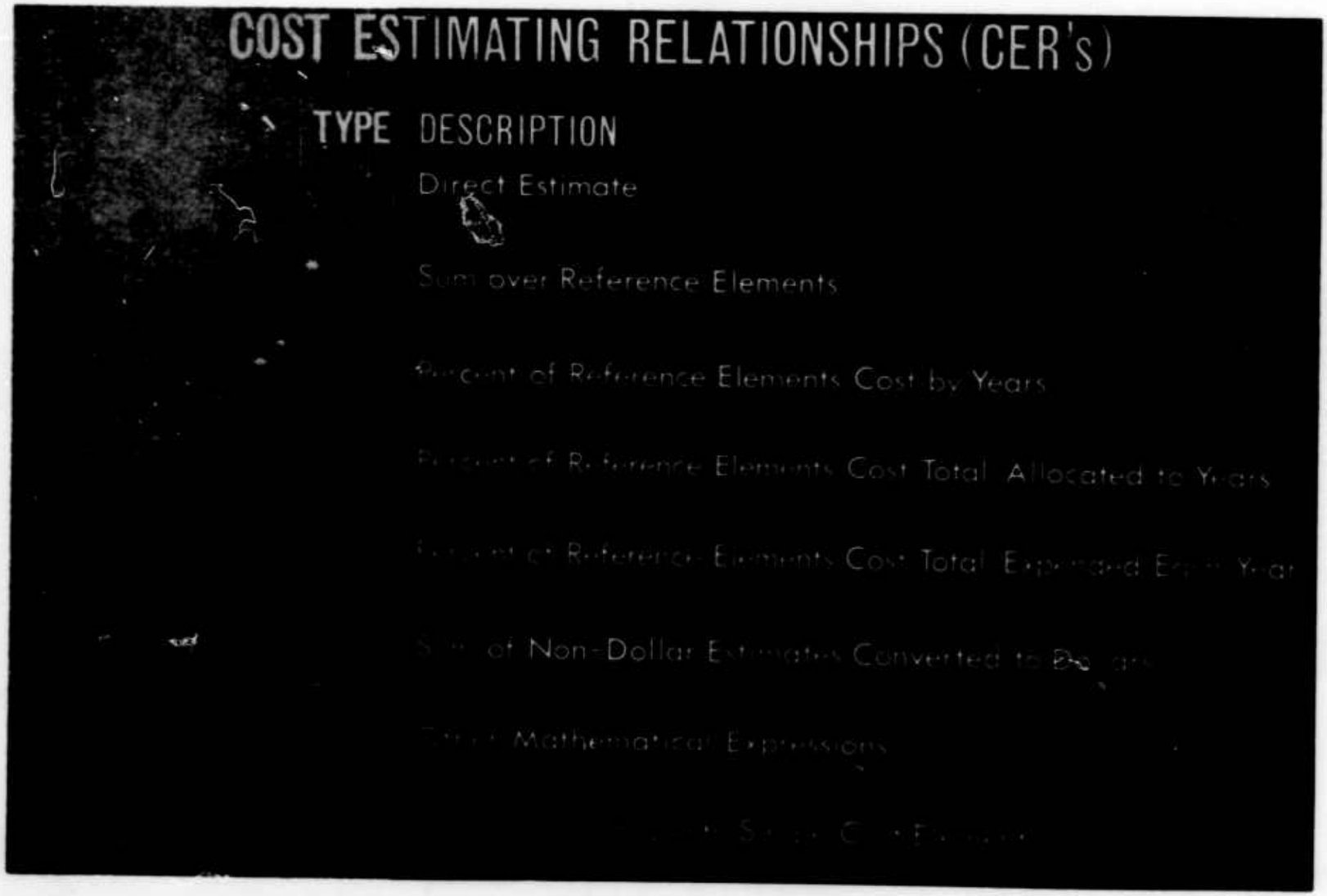
COST ESTIMATING RELATIONSHIPS (CER's)
TYPE
DESCRIPTION
Direct Estimate
Sum over Reference Elements
Percent of Reference Elements Cost by Years
Percent of Reference Elements Cost Total Allocated to Years
Percent of Reference Elements Cost Total Expressed Each Year
Sum of Non-Dollar Estimates Converted to Dollars
Other Mathematical Expressions

FIGURE 4

2.5.1 Standard Tables

To satisfy frequently recurring needs, a set of standard tables is provided:

Table Type	Title
A	Summary Cost Estimate (by major cost elements)
B	Detailed Cost Estimate (by intermediate cost elements)
C	Summary Cost Estimate by Budget Codes
D	Subsystem Cost Estimates by Budget Codes
E	Hardware Subsystems Cost Estimates by Budget Codes

Formats of these tables are shown in Appendix A, Exhibit 2, pages 81 to 85. The costs in the first three tables are aggregated by the three output cost categories, RDT&E (Research, Development, Test, and Evaluation), Initial Investment, and Operations. The costs in the last two tables are aggregated by the appropriate subsystems of the structure. These tables can be used to show total system costs over all phases of a system life cycle, for a particular phase, or for sub-subsystems of the nine subsystems. This capability, called the multi-pass feature, is described in Section 2.6.

2.5.2 Analytical Data

The standard tables are intended as outputs to the user of cost studies. The cost analyst himself, however, should have more detailed data available so that he can trace the computer operations for analysis purposes. Consequently, a listing of all data inputs, a print out of the structure after all costs were computed* (if the analyst so desires), and, in the case of cost sensitivity analyses, a list of the changes made for each run of the program, are produced.

2.6 Multi-Pass Feature

The computer program has been designed with a multi-pass feature (Fig. 5) which permits aggregation of cost estimates for more than one set of input cost element estimates. Hence, while the capacity of the model permits estimating the costs of only one set of nine subsystems at a time (called a pass), the multi-pass feature permits the analyst to obtain total system, i.e., run, costs while aggregating system costs by:

a) Packages or Phases

Electronic systems are frequently acquired in an evolutionary manner with each incremental improvement being called a package or phase. In such cases, costs are desired separately for each package as well as for the system as a whole.

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*See table SIS of Appendix A, Exhibit 2, pages 86 through 95.

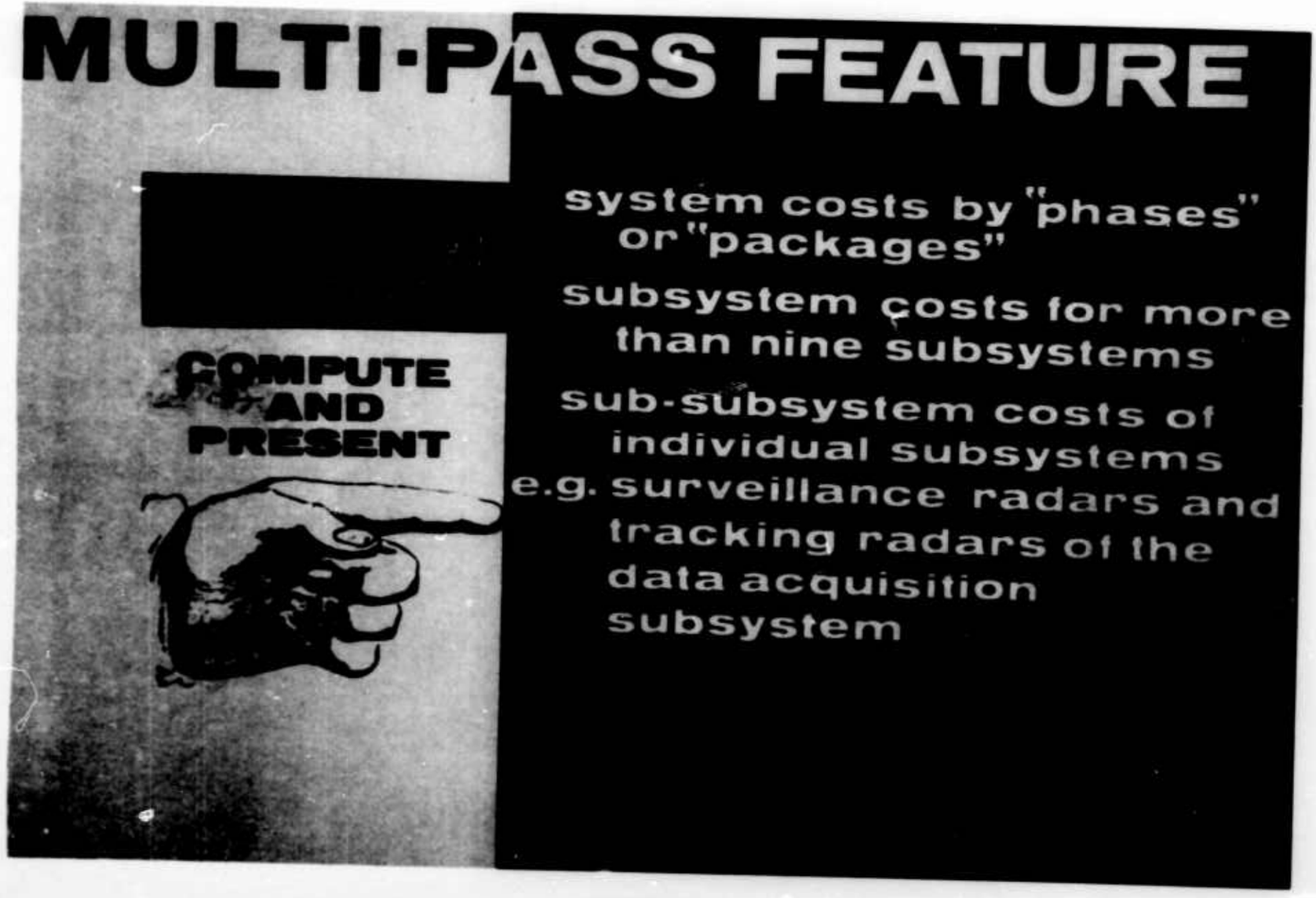
MULTI-PASS FEATURE
COMPUTE AND PRESENT
system costs by "phases" or "packages"
subsystem costs for more than nine subsystems
sub-subsystem costs of individual subsystems
e.g. surveillance radars and tracking radars of the data acquisition subsystem

FIGURE 5

b) More than Nine Subsystems

If an analyst desires to estimate costs for more than nine subsystems, he may do so by making additional passes and accumulating the results to obtain total system costs.

c) Identification of Costs of Sub-Subsystems

An analyst may desire a breakdown of sub-subsystem costs. This can be accomplished by making a separate pass for each sub-subsystem and then aggregating costs for the subsystem as a whole.

In addition to the time-phased costs by pass or total system (run) listed in section 2.5.1, summary costs by passes (with the system total also presented) are available. Page 96 in Appendix A, Exhibit 2, is an example of this type of table.

2.7 Sensitivity Analysis

The computerized model is designed to provide the multiple outputs required for a cost sensitivity analysis. Cost sensitivity analysis is performed to determine the relative changes in system cost obtained when different values are assigned to selected parameters. Parameters which are determined to be relatively cost-sensitive possess a significant pay-off potential in terms of allocation of limited resources and therefore deserve special attention in system planning and design.

Cost sensitivity analysis is accomplished as follows. The initial input data associated with the first run are stored. The analyst specifies for succeeding runs only the changes he desires to make. These changes (Fig. 6) may be any or all of the following:

a) New values for the input cost element estimates
b) Different values for cost factors or percentages
c) Incremental changes to cost factors or percentages along with the number of times these increments should be applied.

In Cases a and b, if several runs are made, all data that were modified in the previous run are first restored to the values they had in the original run. Thus, for a change to be carried through several runs, it must be respecified for each run. In Case c, increments to the factor are cumulated and data are restored only after the specified number of incremental changes is made. For example, for five increments of ten, 10, 20, 30, 40, and 50 are added to the original value for the five runs.

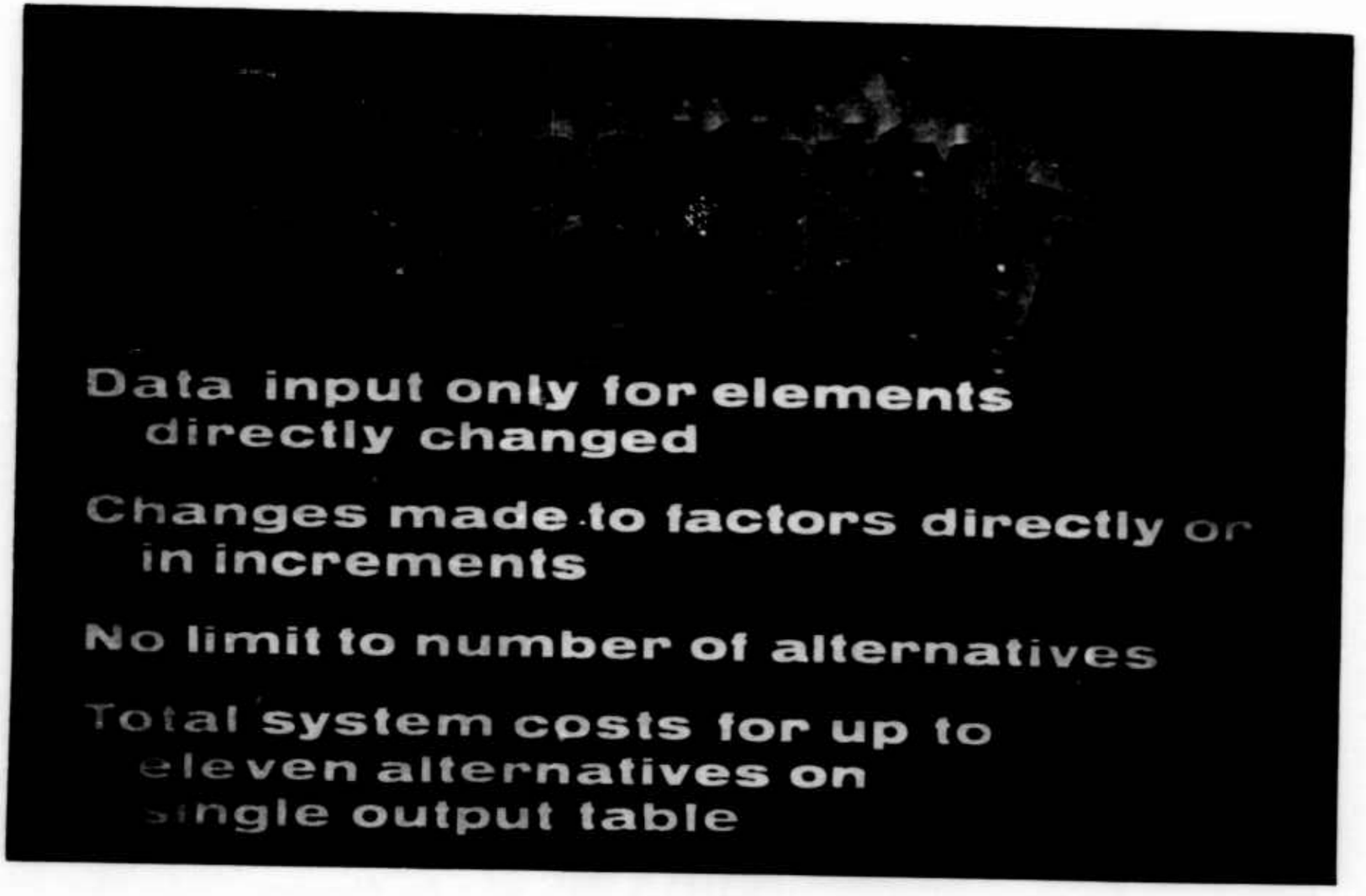
Data input only for elements directly changed
Changes made to factors directly or in increments
No limit to number of alternatives
Total system costs for up to eleven alternatives on single output table

FIGURE 6

In addition to printing out the tables specified for each run, total (non-time phased) costs for each run are stored in a single summary table (Table R) with the totals for up to eleven runs presented on a single sheet for analysis.*

2.8 Planned Extensions

The features described are now available on the operational model. As experience is gained, changes and improvements will be made in the output formats, structure and CERs, and this manual will be appropriately updated. In addition to such normal evolutionary changes, specific areas for improvement and extension of the model have been identified (Fig. 7). It is planned to program the operational model for the IBM 7030 in the Fall of 1963; at that time, minor changes and at least the first extension (Section 2.8.1) will be incorporated.

2.8.1 Transformation Coefficients

Cost estimates derived by the initial model are usually time-phased in terms of total obligational authority. Other possible time-phasings are by year of expenditure, i.e., when payments are made, or by year of delivery, e.g., when equipment is delivered or when personnel are trained. The time-shifting of costs from one of these three modes to another can be accomplished by factors called transformation coefficients, which are stored in the computer and are subject to change by the analyst for a particular analysis.

2.8.2 Uncertainty Estimates

It is highly desirable to provide estimates of the accuracy associated with cost estimates. Major areas of uncertainty in system cost estimates are (1) uncertainties related to what is costed, i.e., the system description, and (2) uncertainties in the costs estimated for a given system description. Estimates of the second type of uncertainty can often be developed with standard statistical procedures, while cost sensitivity analysis coupled with subjective probability techniques can be used to show how costs vary with variations in system parameters.

Provisions will be made to incorporate in the model estimates of the uncertainty associated with the various input elements. Using such data, estimates of the uncertainty -- measured, for example, by the standard error -- can be obtained for elements in the output formats. These, in turn, can be converted to subjective confidence statements concerning the probability, called the confidence coefficient, that estimated costs lie within calculated confidence limits.

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*See Table SAM in Appendix A, Exhibit 2, page 97.

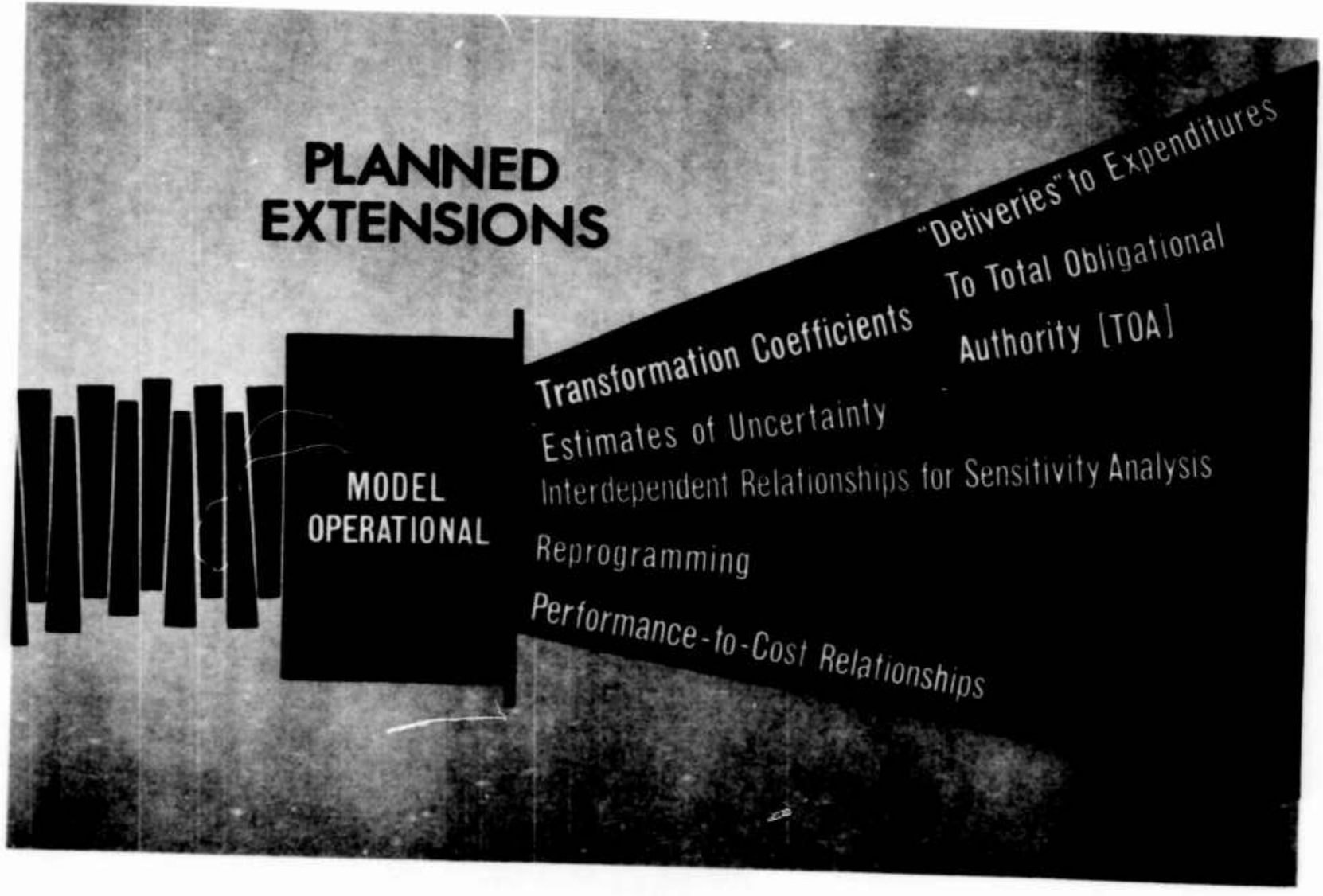
PLANNED
EXTENSIONS
MODEL
OPERATIONAL
Transformation Coefficients
Estimates of Uncertainty
Interdependent Relationships for Sensitivity Analysis
Reprogramming
Performance-to-Cost Relationships
"Deliveries" to Expenditures
To Total Obligational
Authority [TOA]

FIGURE 7

2.8.3 Interdependent Relationships for Sensitivity Analysis

The cost sensitivity analysis procedure described in Section 2.7 requires the analyst to specify the elements he desires to change directly. In subsequent modifications to the model, a set of inter-relationships between elements will be stored in the computer to permit a more automated sensitivity analysis to be performed.

2.8.4 Reprogramming

Once resources have been committed to the acquisition of an electronic system, it is often necessary to determine the costs of possible reprogramming actions such as changes in schedule, e.g., either end dates or intermediate milestones, changes in configuration, such as number of units or sites to be included, and changes in the acquisition plan. It is also necessary to estimate the effect on schedules caused by the imposition of new budget constraints. The computerized cost model will be extended to include a capability to estimate system costs when any of the above changes occur or are simulated.

2.8.3 Performance-to-Cost Relationships

The set of CERs initially developed for the cost model pertains to the relationship between system elements and cost. CERs that relate performance and functional parameters to cost would be particularly useful in the system requirements and advanced planning stages of the system cycle when details of the system configuration are not known. As such CERs are developed, modifications will be made to the cost model computer program to provide for their use. These performance-to-cost relationships would permit costing directly from the system description formats mentioned in Section 2.3.

3.0 PRIMER

This chapter is intended to provide a more detailed description of the model, and is oriented to the analyst using the model. The first section (3.1) discusses the input cost element estimates and describes the sheets used for recording the data. The next section (3.2) discusses briefly the Cost Estimating Relationships (CERs) which have been programmed for the model. The factors and percentages associated with the CERs are discussed in section 3.3. The types of output tables available and the necessary specifications to generate them are discussed in the following section (3.4). Finally, the manner of specifying changes for sensitivity analysis is described in Section 3.5.

3.1 Input Cost Element Estimates

Exhibit 1 in Appendix A presents the data sheets used in preparing the system cost estimate. The first ten pages of the exhibit, 65 through 74, are the Input Cost Element Estimate Sheets, one sheet for each of the nine subsystems of the electronic system and a tenth with identical column headings but no preprinted data. The latter is used for changes to the usual method for estimating costs, for recording additional cost elements, and for changing input cost element estimates in sensitivity runs. Only the non-shaded columns are key punched, and these under control of a check in the first column. The shaded columns assist the analyst in preparing the estimate.

The input cost element estimate sheets in the exhibit provide an example of the amount of data usually required from the analyst to cost a subsystem in one pass. It should be noted that in general less than one-half of the elements require input estimates, although each cost element is checked at least once, so that at least one card is prepared for each element. Those elements with starred CERs (requiring no input data) do not require any entries in the "Y" field, while a "7" is required in the "Y" field for those elements which are not to be costed and do not have starred CERs. The X's in the "years" fields indicate where numbers were inserted for the purpose of calculating the sample output tables shown in Appendix A, Exhibit 2.

A set of sheets is filled out for each pass of the first run, the pass being identified at the top of the sheet in the space provided.

Since more than one CER is available to the analyst for some of the elements, the analyst must insert a check in field one for all lines he desires key punched. If any costs are estimated for a subsystem, at least one card must be key punched for every element in that subsystem. If the analyst does not desire to cost an element, he merely writes a "7" in field ten for the first line of that element; this code sets the costs for that element to zero, and thus eliminates the need for key punching any additional

cards required by the CER. However, additional cards may be required for the first run in certain sensitivity analysis cases (see section 4.1.3).

If no costs are associated with any of the nine subsystems for any particular pass, it is necessary to make only one entry for each of such subsystems. The usual CERs for the first element of these subsystems are changed to 99XX where XX refers to the subsystem number (01 through 09) and a scale factor (field ten) of "0" (not "7") is entered. The computer program will then automatically set all cost elements for these subsystems to zero costs. However, if costs are to be estimated in subsequent runs for the same pass for which a subsystem is "zeroed" in the first run, the 99XX CER (called CER 99) must not be used; rather, cards must be entered for every element, with the first card of each element containing a "7" in field ten. Also, CER 99 cannot be used in subsequent runs to "zero" a subsystem which was costed in the first run; cards with a "7" in field ten must be input in the sensitivity run for each element of the subsystem.

Field one contains a check if the line is to be key punched (see above).

Field two contains 06, the card code which identifies the data as an input cost element estimate. Card codes associated with other types of data are described below.

Field three, which is not key punched, contains the element name and number. The element name appears on the output table of the Cost Estimating Structure. The element number is organized to show the different levels of the structure and the additive relationships among the elements; for example, element 21200 is the sum of elements 21210, 21220, 21230, and 21240 while element 21210 is the sum of 21211 and 21212.

Field four contains the sequence number. The number specifies the order in which the elements are stored in the structure, thus providing the means by which the computer locates the element for generating costs of other elements or output tables.

Field five contains a shortened budget code that is not used for developing the output tables organized by budget codes in the current operating program. This code is octal; a "7" is used rather than an "8" for P800 funds, and "0" signifies an element which is the sum of costs with different budget codes.

Field six contains the four-digit code of the CER usually used in estimating the cost of the element. The two leftmost digits of the code represent a particular CER formula; these currently range from 00 to 35 plus the special 99. The two rightmost digits -- the CER line number -- are numbered serially; the maximums for each CER vary with the expected use of the CER and currently range from 3 to 100.* The entire CER code uniquely identifies parameters required to cost that element.

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*There is no maximum for CERs such as 01, Direct Dollars, which require no parameters.

Field seven contains the card number associated with an element and particular CER. The exact number of cards associated with a CER must be prepared if any non-zero cost estimates (direct or indirect) are entered for that element. However, if no costs are to be obtained for that element, only one card is necessary. (See Section 4.1.3 for exceptions to these rules.)

The next two fields, eight and nine, provide the analyst with information about the usual CER listed in field six. Field eight identifies the unit of measure for the data in fields thirteen through twenty-two (and also possibly field twelve). An asterisk in field eight indicates that no data other than those in fields two and four through seven need to be key punched. Whenever the unit of measure is a percentage, field nine references the elements of which the percentage is being taken.

In field ten a scale factor ranging from zero to six provides the analyst the flexibility of specifying his data over a wide range of values; the scaling applies to the "years" data, fields thirteen through twenty-two. If the unit of measure is dollars, the scale factor is interpreted as a positive exponent of 10, so that the analyst can input from $1 using a scale factor of zero, to $99,999,000,000 by using a scale factor of six. If the unit of measure is not dollars, the scale factor is treated as a negative exponent of 10, so that the analyst can input from .000001 using a scale factor of six to 99,999 using a scale factor of zero. A scale factor of seven in the first card of the element indicates that no costs are to be calculated for that element.

In field eleven a scale factor associated with the prior years total column is indicated. Exponents zero through six are used when the total for prior year(s) is given in dollars; a seven in this field signifies that the prior years total is given in the same unit of measure of fields thirteen through twenty-two, and the scaling is identical to that specified by field ten.

The estimate of all years prior to year N is entered in field twelve which has provision for six digits. To enter a dollar estimate in field twelve for prior years, codes 0 through 6 are used in field eleven. To estimate prior years costs in the same unit of measure as later costs, code 7 is used in field eleven.

Fields thirteen through twenty-two are used to enter time-phased estimates (maximum of five digits) for years N through N + 9. The year corresponding to year N is specified along with other control information on Cost Model Work Sheet #1. As mentioned previously, the unit of measure of each entry is given in field eight, with the data scaled by field ten.

The last field, twenty-three, contains a sort code for arranging the data into a sequence which permits costs to be computed with a minimum number of iterations. For example, the total for Data Processing

(element 20000) cannot be calculated until the Mission Equipment (21000), AGE (22000), and Replacement Maintenance and Rentals (23000) costs have been computed. The sort codes for these elements are thus assigned to reflect this fact.

3.2 Cost Estimating Relationships

The CERs currently available in the computer may be organized into seven groups.

3.2.1 Direct Dollar Estimates

Two CERs, 01 and 24, are available for operating on direct dollar estimates. In CER 01, the analyst estimates time-phased direct dollar costs; a total over years is calculated and the total and time-phased costs are stored in the proper locations of the structure. In CER 24, Multiple Direct, the analyst estimates four sets of time-phased direct dollar costs; these four costs are summed for each time period, and these time-phased costs and the total over years are stored in the structure.

3.2.2 Totals

Nine CERs -- 02 through 10, Total of 2 through Total of 10 -- calculate dollar totals of two through ten elements. Total costs are obtained for individual years and a total over years. No inputs in fields thirteen through twenty-two are required for these CERs.

3.2.3 Percentages

The CERs related to percentages are classified into three types: Percent Direct, Percent Spread, and Percent Operations.

Percent Direct and Percent Spread are usually used in the RDT&E and Initial Investment phases. Total costs for an element are calculated as a percentage of some reference element; the time-phasing is then specified by the analyst either in the same time-phased pattern as the reference element (Percent Direct) or some other time-phased pattern (Percent Spread). Percent Operations is normally used for generating operating costs where each annual operating cost is a percentage of some initial investment cost.

3.2.3.1 Percent Direct

Two CERs -- 11 and 12, Percent Direct (1) and Percent Direct (2) -- calculate costs as a direct percentage of the cost (or sum of costs) of some reference element(s). The costs are time-phased in an identical fashion as the reference elements; hence, no inputs are required for fields ten through twenty-two. For CER 11, the cost is calculated as a percentage of a single

reference element, while for CER 12 the cost is calculated as a percentage of the sum of two reference elements.

Element 21122, Development Tooling and Test Equipment, is an example of the use of CER 11. The costs of element 21122 are assumed to be allocated in the identical time-phased spending pattern as the reference element 21121, Mockups, Prototypes and Other. Consequently, the costs of element 21121 for each year are multiplied by a percentage stored in the Factor and Percentage table to generate the corresponding year's costs for element 21122. If 25 percent of element 21121's costs were in Year N and 75 percent in year N + 1, then 25 percent of element 21122's costs would also occur in year N and 75 percent in year N + 1.

3.2.3.2 Percent Spread

In Percent Spread, a percentage is taken of the total cost (or sum of costs) of the reference element(s), and the costs then time-phased by percentages which sum to 100 percent that the analyst enters in fields twelve through twenty-two. If direct dollars are input in prior years total, the percentages input in fields thirteen through twenty-two must sum to less than 100 percent.

In CER 13, Percent Spread (1), the total costs of a single reference element are spread, and in CER 14, Percent Spread (3), the sum of the total costs of three elements are spread. CER 25, Multiple Percent Spread, is a special percent spread currently used only for an element in the facilities and support subsystem. As in CER 14, the sum of total costs of three reference elements are spread. However, four different inputs, each with independent percentage allocations, are used for spreading these costs, and the time-phased costs for each time period are obtained as the sum of costs spread by the four allocations.

An example of the use of CER 13 is element 21230, First Destination Transportation (FDT), costs of which are generated as a percentage of the reference element 21210, Prime Equipment. As contrasted to the Percent Direct case, however, costs of element 21230 are usually not generated in the same time-phased pattern as element 21210. If Prime Equipment costs were spread evenly over year N + 2, N + 3, and N + 4 for example, and the transportation costs were to be allocated evenly to years N + 4 and N + 5, the analyst would enter 50 percent in each of the latter two years for the FDT element (input = 5 with a scale factor Y = 1). The total Prime Equipment cost would then be multiplied by a stored FDT percentage and the product allocated 50 percent to year N + 4 and 50 percent to year N + 5.

Element 91240, Contingencies, is the only element using CER 25. Four sets of time-phased percentages, each totaling 100 percent, are entered in fields twelve through twenty-two to represent the time-phasing of site

exploration, construction supervision, contractor's overhead and profit and contingencies. The total costs of each of these four items is computed by multiplying the respective stored percentage by the sum of the totals of elements 91210, 91220 and 91230.

3.2.3.3 Percent Operations

CER 15, Percent Operations (1), is closely related to the Percent Spread CER 13 except that the sum of input percentages is not a criterion. A percentage is taken of the total cost of the reference element, and the costs are then time-phased by annual percentages entered by the analyst in fields twelve through twenty-two. These annual percentages are usually 100 for normal operating conditions, less than 100 for partial operations, as for example, during implementation or phase out, and may be greater than 100 for years with special requirements.

Follow-on spares, element number 23110, is an example of Percent Operations. Assume that the system will build up to full operating level in the interval from year N + 3 to year N + 4, will operate normally for the four years N + 5 to N + 8, and will then phase out in one year. The analyst would enter 33, 67, 100, 100, 100, 100, and 50 percent as 33, 67, 100, 100, 100, 100, 50 in years N + 3 to N + 9 respectively with scale factor = 2. For each of these years, the percentage is multiplied by the product of the stored factor for follow-on spares in percent per year and the reference element total, i.e., the total of element 21210, to generate follow-on spares costs.

3.2.4 Factors

CERs 16, 17 and 18, Factor (1), Factor (2), and Factor (3), convert estimates of resources such as "number of instructions" or "man-years contractor engineering" to dollars through the use of factors such as dollars per instruction or dollars per man-year contractor engineering. In CER 16, one resource estimate is entered and converted to dollars; in CER 17 two resource estimates for the same element are entered, converted to dollars, and summed to obtain the element cost estimate; in CER 18 three resource estimates for the same element are entered, converted to dollars, and summed to obtain the element cost.

3.2.5 Mixed Direct Dollars, Percents, and Factors

CERs 19 through 23 and 27 are combinations of direct dollars, percents and factors. These CERs give to the analyst considerable flexibility in calculating costs since he may combine estimates of various types.

CER 19, Percent Spread Special, is a variation of percent spread in which the total for "reference element" is replaced by the product of a

stored factor and data entered in field thirteen of the second card of the element associated with the CER. For example, in element 81220, Positional Handbooks, the time-phased percentages which define the spending pattern are entered in the first card as in CER 13, but then the percentages are applied, not to some reference element total, but to the product of the data in field thirteen of the second card (number of operator positions) and a cost factor (dollars per operator position).

CER 20, Factor (1) + Direct Special, is a sum of direct dollars and resources converted by a variable factor. The resource estimates are entered on the first card; direct dollars are entered on the second card; and data are entered in field thirteen of the third card. The variable factor associated with the resource input is obtained by multiplying the entry on the third card by a stored cost factor.

An example of the use of the CER can be seen in element number 81210, Initial Training (Operational Personnel), where the time-phased resources on the first card, number of men to be trained each year, are multiplied by the product of the average length of the training course entered in field thirteen of the third card and a cost factor representing dollars per man-month for training. Added to these time-phased costs are the time-phased direct dollar costs of special training aids entered on the second card.

CER 21, Factor (2) + Direct Special, is a sum of two resource estimates on cards one and two, a direct dollar estimate on card three, and a variable percentage computation.

The variable percentage computation consists of multiplying time-phased entries on the fourth card by the product of a stored percentage and the sum of the totals of five reference elements.

An example of the use of this CER can be seen in element number 12130, Intra-System Integration Tests, where the four time-phased data inputs are in terms of: 1) man-years contractor engineers; 2) man-years contractor technicians; 3) dollars for test equipment; and 4) months of testing. The first three cards are treated as described in CERs 17 and 01. The analyst enters in the fourth card the duration (in months) of the testing program in its applicable years; for each year's input, the number of months is multiplied by a product of (1) a percent per month and (2) the sum of the prime equipment hardware costs, i.e., the totals of elements 21210, 31210, 41210, 51210 and 61210, to give a cost for spares consumption during the tests.

CER 22, Factor (4) + Percent Spread, is a combination of four resource estimates and a percent spread.

CER 23, Factor (4) + Direct Special, is the same as CER 21 except that there are four resource estimates instead of two.

CER 27, Factor (2) + Direct, is a combination of two resource estimates and a direct dollar estimate.

3.2.6 Move and Subtracts

Move and Subtract CERs are currently used only in the generation of output tables.

CER 26, Move, sets the time-phased costs of a table entry equal to the time-phased costs of a structure cost element or another table entry.

In CERs 28, 29 and 30, Subtract (1), Subtract (2), and Subtract (3), the time-phased costs of an element or table entry are diminished by the time-phased costs of one, two or three other elements or table entries, respectively. CER 33, Total of (4) Minus (1), subtracts the time-phased costs of one element or table entry from the sum of time-phased costs of four other elements or table entries.

3.2.7 Unassigned CER Numbers

CERs 31,* 32, 34, and 35 are presently unassigned. These CERs will be utilized as other mathematical functions such as exponential and multiple regression relationships are developed.

3.3 Factors and Percentages

Essential to cost estimation are the factors and percentages used by the CERs; in Appendix A, Exhibit 3, is a listing of the current factors and percentages. Since the values for these factors and percentages have been developed from a continuing analysis of past data and are constantly being updated and improved, no numeric values are shown.

The basic set of factors is maintained on a deck of cards which is input at each model processing time. Thus, one may change values or add factors merely by changing or adding cards. The analyst specifies these changes or additions on Cost Model Work Sheet #1 (Appendix A, Exhibit 1, page 75).

3.4 Output Table Control

As indicated in Section 2.5, eight standard output tables can be generated by the model (see Appendix A, Exhibit 2, for sample tables). Six of the eight tables, viz., A, B, C, D, E, and S may present either pass or run information. Table P (Table A over passes) is associated with a single run while Table R (Table A over runs) presents summary data for a set of runs. The analyst selects the particular tables he desires and specifies a table number and the number of decimal places by appropriate entries on Cost Model Work Sheet #1 (MCF 1009n).

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*CER 31 is temporarily being used as a continuation of CER 29 until the next model updating.

Provision is made on this work sheet to identify the system by name or number, along with the number of passes per run and the number of runs to be made.

For the first run the analyst assigns a run number and for Tables A, B, C, D, E, S, and P, specifies "print" or "not print." If print, the number of decimal places and table number to be assigned are specified, where tables give results in millions of dollars and a table number of three alphanumeric characters is permitted. Also specified is the same information for the individual passes of the first run with the exception of Table P.

In the case of a sensitivity analysis, the analyst can select for printing any of the tables described previously for any pass or run. Usually, however, the same sets of tables are desired for all subsequent runs (and passes of each run) after the first. Provision is made on Work Sheet #1 for table specifications for these subsequent runs. Also on the work sheet, the analyst specifies the number of decimal places and table number for Table R which is printed whenever multiple runs are made.

3.5 Multi-Pass Feature

Several uses of the multi-pass feature are outlined in Section 2.7. An example of its use is presented here.

It may be desirable to aggregate and present system costs by functional groupings in addition to the resource aggregations represented by the nine subsystems. For example, in determining the costs for SAGE, System 416L, it may be desirable to show in separate tables the costs of direction centers, long-range radars, gap filler radars, ground-to-air radio sites, etc. By assigning a separate pass to each of these functional groups, the costs for each, as well as the grand total system cost, can be identified.

The planning for the cost analysis of the SAGE 416L system is facilitated by the completion of a table similar to Table 1.

3.6 Changes for Sensitivity Analysis

Changes for a sensitivity analysis are centered on the blank Input Cost Element Estimates Sheet (MCF 1009j) and on Cost Model Work Sheet #2 (MCF-1009o) shown in Appendix A, Exhibit 1, pages 74 and 76 , respectively.

The changed element estimates are entered in the same manner as original element estimates with the exception that the card code (field two) is changed from 06 to -6. The pass and run number associated with the changed element must be specified for each change at the top of the form. Element numbers of these element changes are entered on Work Sheet #2 for ready reference in identifying the run in which the change is made.

TABLE 1

EXAMPLE OF ORGANIZATION OF SAGE DATA FOR
COSTING BY ELECTRONIC SYSTEM COST MODEL

Subsystem \ Pass	Direction Centers 1	Long-Range Radars 2	Gap Filler Radars 3	Ground-to-Air Radio Sites 4	etc.
General System					
Data Processing	X	X			
Data Presentation	X				
Communication	X	X	X	X	
Data Acquisition		X	X		
Aerospace Vehicles				X	
Computer Programs	X	X			
Personnel	X	X	X	X	
Facilities & Support	X	X	X	X	
PASS TOTAL					

If the analyst desires to change the CER associated with an element from one run to another, the number of cards associated with the modified CER must not exceed the number of cards associated with the original input cost element data for that element. (See Section 4.1.3, "-6 cards," for detailed discussion of this point.)

Changes to factors, identified as N in the "N or I" column, are entered on Work Sheet #2 along with the run number in which the change is to be made. For incremental changes to factors, the number of the first run in which the increment is to be effected is entered along with the factor number, size of increment, identification as increment (I in "N or I" column) and number of increments to be effected.

The incremental change is considered additive, i.e., the increment for a run is added to the value of the increment of the previous run. The original value of the factor is not restored until the specified number of increments has been accomplished. For example, if the original factor is 20 percent and three increments of 3 percent are to be made starting with the second run, the values of the percentage for runs 1 through 5 are 20, 23, 26, 29, and 20 percent, respectively.

4.0 REFERENCE MANUAL

The flexibility designed into the computerized cost model is achieved at the expense of some simplicity in its operation. Hence, the utilization of the many features of the model can best be achieved by training a technical specialist to prepare and organize the cards for computer processing, and to edit the data prior to processing. This chapter, which is oriented toward the specialist's needs, describes procedures for incorporating and processing data into and through the model. The procedure is developed in Sections 4.1 through 4.6 (1 through 6, respectively):

1. Types of cards used with the model and steps required to translate analyst's specification from work sheets #1 and #2 to key punch sheets (Exhibit 1).

2. Organization of data for entry into the computer, including an illustrative 1401 listing of cards.

3. Table Tape containing the nomenclature for the structure, all standard output tables, and formula specifications for generating the tables.

4. Procedures for efficiently using available CERs.

5. Problems and methods of modifying the cost structure.

6. Methods of checking for errors before and after key punching, including computer error diagnostics.

4.1 Types of Cards

Eleven card formats are currently used in the cost model. These may be organized into three types: model cards, control cards, and system data cards. Model cards contain data which are usually, but not necessarily, independent of the system being costed. Control cards are used to define the number of systems, number and type of sensitivity runs per system, and passes per run. In addition, they are used to specify the desired outputs. System data cards contain time-phased cost element estimates and the changes for sensitivity runs. Table 2 lists the card code, type, and name for each of the eleven formats.

Table 2

Types of Cards Used in Cost Model

Card Code	Card Type	Card Name
00	Control	Header
01	Control	System
02	Model	CER Parameter
03	Model	Factor & Percentage Value
04	Control	Run
05	Control	Pass
06	System Data	Input Cost Element Estimate
07	Control	Sensitivity Element Change Count
-1	System Data	Sensitivity Factor & Percentage Increment
-3	System Data	Sensitivity Factor & Percentage Change
-6	System Data	Sensitivity Input Cost Element Change

All entries in the data tables used in the model are identified by a four-digit code. The leading digit defines the type of data; the following three digits are a sequence number for each particular type. The codes are:

Code	Type of Data
1xxx	Element in Structure (Table S)
2xxx	Factor or Percentage
3xxx	Element in Table A or B
4xxx	Element in Table C, D, or E

The actual values for the 1xxx codes are given by the Sequence Numbers, field four, of the Input Cost Element Estimates Sheets in Exhibit 1; the values for 2xxx are given by the factor numbers in the Factors and Percentages listing of Exhibit 3; and the 3xxx and 4xxx codes are defined in Exhibit 5.

4.1.1 Model Cards

Two of the eleven card formats may be considered model types; these are 02, CER Parameters, and 03, Factor and Percentage Values.

02 - CER Parameters

CERs operate on data stored in locations specified by the CER parameter cards. A maximum of ten parameters may be associated with a CER, e.g., CER 10 and 23 each require ten. No CER parameter cards are required for CERs 01, 24, 99.

The parameter cards contain the following information in the designated columns:

Card Columns	Information
1-2	Card Code
3-4	CER Number
5-6	CER Line
7-8	Subsystem Number*
9-12	Sequence Number (Structure or Table)
13-14	Number of Parameters
15-18	First Parameter
19-54	Second Through Tenth Parameters as required
55-72	Blank
73-80	Identification

*Numbers 21 through 25 represent Tables A through E, respectively.

The identification field, which is punched in columns 73 to 80 for all types of cards, completes the data on the card. The identification field consists of a system code, a run number, a pass number, and a sort code as follows:

Card Columns	Information
73	System Code
74-75	Run Number
76-77	Pass Number
78-80	Sort Code

For model cards, where system, run and pass have no meaning, zeroes are key punched. The identification field is not read by the computer but is used to identify the data for future use and to arrange the data for input into the computer. See Section 4.2 for further discussion of this subject.

The key punch sheet (MCF 10091) for parameter cards is presented in Exhibit 1. The 02 cards currently used with the model are presented in Exhibit 3.

CER 2101 is an example of how the parameter cards are developed and may be interpreted. This CER number is located on page 104, and shows the relevant subsystem to be 01. The sequence number, 1007, identifies the element using this CER as Intra-System Integration Tests, element number 12130, with eight parameters required to calculate the costs. The first three parameters 2003, 2004, and 2208 refer to factors used to convert Man-Years Contractor Engineers, Man-Years Contractor Technicians, and Months Testing to dollars. The next five parameters refer to sequence numbers 1026, 1059, 1092, 1127, and 1160 (observe that these refer to element numbers 21210, 31210, 41210, 51210, and 61210 on the input data sheet). The fact that only the totals of these five elements are required is incorporated in the mathematics of the CER.

03 - Factor and Percentage Values

Factors and percentages are used by many CERs. These are maintained as a deck of cards which may be updated by exchanging or adding cards. The analyst specifies the additions or changes to factors on Work Sheet #1. These changes or additions are entered on the Key Punch Sheet for Factors & Percentages (and Changes) (MCF 1009m) in Exhibit 1, page 79.

03 is entered as the card code; the last three digits of the factor code, i.e., sequence number, in the 2xxx series, are entered as the factor number (the program will generate the "2" code). The value for the factor is entered in the Value or Increment field in the exponential form shown on the keypunch sheet; for example, 1.54 percent is entered as +1.540E-02,

while $30,000 is entered as +3.000E+04. A description field of fifty-four alphanumeric characters is available for defining the factor and its unit of measure, i.e., dimension. Finally, an identification field completes the card. The card layout is as follows:

Card Columns	Information
1-2	Card Code (03)
3-5	Factor Number (last three digits of sequence number)
6-15	Value (in exponential form)
16-18	Blank
19-72	Description
73-80	Identification

4.1.2 Control Cards

Five of the eleven card types are considered control cards; these are 00, Header; 01, System; 04, Run; 05, Pass; and 07, Sensitivity Element Change Count. The data for the first four card types are completed in the appropriate formats on Key Punch Sheet -- System, Run and Pass Control Information (MCF 1009k) in Exhibit 1. The 07 card type information is entered for key punching on the blank Input Cost Element Estimate Sheet (MCF 1009j) in Exhibit 1. All data in these cards are entered in their respective fields right justified, i.e., with the units position at the extreme right. For example, in the header card field for the number of systems, a "one" would be entered in column 14 and not column 13. The only exceptions to the right justification are the entry of data in the various description fields, where any columns may be used. The information entered on the key punch sheets is obtained primarily from Work Sheets #1 and #2.

00 - Header

The first card in the data deck is a header card. This card contains the following information in the designated columns:

Card Columns	Information
1-2	Card Code (00)
4-5	Month-Numeric
7-8	Day-Numeric
10-11	Year-Two low order digits
13-14	Number of Systems to be Processed
15-72	Description
73-80	Identification

01 - System

Data which describe the relevant system information are entered on the system card. One system card is required for each system being processed. The information required is:

Card Columns	Information
1-2	Card Code (01)
4-9	System Name or Number
11-13	Number of Runs for the System
15-16	Number of Passes per Run
18-19	Last Two Digits of Year Corresponding to Year N on Input Cost Element Estimate Sheet
20-46	Number of Elements in Each of the Nine Subsystems of the Structure, three columns per subsystem.
48	Number of Decimal Places, in millions of dollars, for Table R (Table A over runs)
49-51	Table Number Assigned to Table R (alphanumeric characters)
52-54	Number of Additional Elements in Subsystem Ten, the Artificial Subsystem for Total System Cost and Additions to Structure
55-72	Blank
73-80	Identification

The data for columns 20 through 46 are usually fixed as 016, 033, 033, 035, 033, 033, 020, 037, and 019, the number of elements respectively for the nine subsystems. The non-costing of any elements does not change the number of elements in a subsystem. A card should be entered for each such element with a "7" in field 10. Also, the non-costing of an entire subsystem (using CER 99) does not change the number listed above for that subsystem.

The tenth subsystem normally contains only one element, the total for the nine subsystems. For this case, columns 52-54 are zero. Additional elements added to any subsystem are placed in the tenth subsystem and CERs are modified appropriately. The number of elements in the tenth subsystem will then be only the number of additions. The subject of additions to the structure is discussed in more detail in Section 4.5.2.

04 - Run

A run card is prepared for each run to specify the output tables desired for that run. In addition, for runs beyond the first, i.e., base

case, the run card lists the numbers of each of the three types of sensitivity changes which are permissible. Run cards contain:

Card Columns	Information
1-2	Card Code (04)
4-9	System Name or Number
11-13	Run Number
14-16	Blank
18	1 = Yes, 0 = No--for printing Table A
20	Number of Decimal Places in Table A (if 1 in Column 18)
21-23	Table Number for Table A (alphanumeric characters) if 1 in column 18
25-65	Similar to Columns 18, 20, and 21-23 for Tables B, C, D, E, S, and P
67-68	Number of Factors First Incremented in This Run.
69-70	Number of Factors Changed for This Run Only (not including factors controlled by increments)
71-72	Number of Input Cost Element Estimate Cards Changed for This Run Only.
73-80	Identification

05 - Pass

A pass card is prepared for each pass of each run, and is used solely to specify the output tables desired for that particular pass. The format used to specify run output is used to specify pass output; thus, the pass cards contain:

Card Columns	Information
1-2	Card Code (05)
4-9	System Number
11-13	Run Number
15-16	Pass Number
18	1 = Yes; 0 = No--for Printing Table A
20	Number of Decimal Places in Table A (if 1 in Column 18)
21-23	Table Number for Table A (alphanumeric characters) if 1 in Column 18
25-58	Similar to Columns 18, 20, and 21-23 for Tables B, C, D, E, and S.
59-72	Blank
73-80	Identification

07 - Sensitivity Element Change Count

The sensitivity element change count card is required to identify the pass associated with input element changes for sensitivity runs. One card is required for each pass in a run in which input elements are changed. The card contains the pass number and the number of input element cards (not number of elements) which are being read in. The information is recorded on the blank Input Cost Element Estimates Sheet (MCF 1009j). The card code of 07 is entered in field 2 (card columns 1-2), the pass number is entered in the two low-order positions of field four (card columns 5-6), the number of cards input is entered in the two low-order positions of field 6 (card columns 12-13) and identification is entered in card columns 73-80.

4.1.3 System Data Cards

The remaining four card types are considered system data cards. One, 06, Input Cost Element Estimates, is associated with the first run. The other three, -1, Sensitivity Factor and Percentage Increments; -3, Sensitivity Factor and Percentage Changes; and -6, Sensitivity Input Cost Element Changes are associated with the three types of sensitivity changes allowed for runs beyond the first. The data for 06 cards are recorded for key punching on the Input Cost Element Estimates Sheets (MCF 1009a through MCF 1009j), the -1 and -3 data are recorded on the Key Punch Sheet for Factors and Percentages (and Changes) (MCF 1009m), and the -6 cards are key punched from the blank Input Cost Element Estimate Sheet (MCF 1009j).

06 - Input Cost Element Estimates

The fields of the Input Cost Element Estimate Sheets are described in detail in Section 3.1. The key punch columns for each field are:

Card Column	Field No.	Field Name
NP*	1	Check Column
1-2	2	Card Code (06)
NP	3	Element Name & Number
3-6	4	Sequence Number
7**	5	Budget Code (Octal)
8-9**	(Not Shown)	Subsystem Number (Octal)
10-13	6	Usual CER Number
14	7	Card Number
NP	8	Unit of Measure

*NP designates not punched.

**Data need not be punched; it is strictly for identification.

Card Column	Field No.	Field Name
NP	9	Reference Element(s) Number(s)
15	10	Scale Factor for "Years" Data
16	11	Scale Factor for "Prior Years Total" Data
17-22	12	Prior Years Total Estimates
23-27	13	Year N Estimate
28-72	14-22	Years (N+1) to (N+9) Estimates
73-77	(Not shown)	Identification - System, Run, Pass
78-80	23	Identification - Sort Code

-1 - Sensitivity Factor and Percentage Increments

The increments to factors or percentages for sensitivity analysis are translated from Cost Model Work Sheet #2 to the Key Punch Sheet for Factors and Percentages. The key punch columns for each field are:

Card Column	Information
1-2	Card Code (-1)
3-5	Factor Number
6-15	Value of Increment in Exponential Form
16-18	Number of Times Factor is to be Incremented
19-72	Description
73-80	Identificat on

A card must be input only for the first run in which the increment is effected. The incremental changes for all following runs will then be performed by the computer, and do not require further specification. Desired output tables for these additional runs, however, must be specified by the appropriate run and pass cards.

-3 - Sensitivity Factor and Percentage Changes

New values of factors or percentages for a single run are entered on Key Punch Sheet for Factors and Percentages using a -3 card. Card Columns 16-18 are blank, the card code (-3) is punched in Columns 1-2, while the other columns are similar to 03 type cards. The identification code contains the run number for which the new value of the factor is applicable. Upon completion of the run, the value of the factor is restored to its original value, thus requiring another -3 card if the same change is desired in any subsequent run.

-6 - Sensitivity Input Cost Element Changes

Changes to the input cost elements for sensitivity runs are made on the blank Input Cost Element Estimate Sheet (MCF 1009j), with -6 replacing 06 in the second field. The data are entered in the fields in the same manner as for original 06 cards with all unshaded columns appropriately completed.

An important restriction on the use of -6 cards is that for any cost element in subsequent runs, no CER may be used that requires more input cards than were used in the initial run. This restriction is necessitated by the manner in which the computer program reads and stores the initial input data. Consequently, additional cards may have to be added in the first run that are not normally required. To illustrate, consider the following cases:

Case 1: Element not costed in first run, but costed in subsequent runs.

In the first run the first card is coded with a "7" in field ten and is blank in fields eleven through twenty-two. Additional cards are added to make up the total number required by the CER used in later runs. The additional cards contain the proper data for fields 2, 4, 5, 6, 7 and 23 and are blank in fields ten through twenty-two. In the subsequent runs where the element is costed, -6 cards are input with the appropriate cost estimates.

Case 2: Element costed in first run, and costed in subsequent runs using a different CER requiring more input cards.

In the first run additional cards must be added to those required for the first run CER until the total number of cards is equal to that of the CER requiring the largest number of cards in any subsequent run. In the additional cards, fields 2, 4, 5, 6, 7, and 23 are properly filled out using the same CER number as that of the original CER and fields ten through twenty-two are left blank. Care must be exercised to assure that the additional cards are physically located immediately behind those of the first run CER. This can be accomplished by changing the sort codes of the subsystem to maintain the proper ordering. In the subsequent runs where the element is costed using the new CER, the appropriate -6 cards are input.

There is no restriction in subsequent runs on using a CER which requires less input cards than the CER of the first run or in not estimating the element in a subsequent run (using one card with a "7" in field ten). Also, there is no restriction on varying the numbers of cards used to estimate an element in different passes of the same run. For example, element 12100, Integration of Subsystems, could use a Factor (4) + Direct Special CER (six cards) in Pass 1 and a Total (4) (one card) in Pass 2.

4.2 Card Organization

The input data cards are organized for processing in a fashion which follows the card numbers:

1. Header Card (00) with number of systems.
2. System Card (01) with number of runs, and number of passes per run.
3. Parameter Cards (02) - No internal order necessary. A blank card is required at the end of these cards.
4. Factor and Percentage Values (03) - No internal order necessary. A blank card is required at the end of these cards.
5. Run Card (04) for first run.
6. Pass Card (05) for first pass of first run.
7. Input Cost Element Estimates (06) for first pass. A blank card is required at the end of these cards. It is recommended these cards be sorted by the sort code in Columns 78-80 for efficient computer processing.
8. Pass Card (05) for second pass, if any, followed by 06 cards and a blank card for second pass.
9. Pass Card (05), 06 cards, and a blank card for third, and subsequent passes, if any. There is no practical limit to the number of passes that may be processed.
10. Run Card (04) for second run, if any, with number of incremental changes, revised factors and percentages and revised input element cards, not elements alone, for all passes in second run.
11. Sensitivity Factor + Percentage Increments (-1), if any.
12. Sensitivity Factor and Percentage Changes (-3), if any.
13. Sensitivity Element Change Count (07) of input card changes for first pass in which elements are changed, if any.
14. Sensitivity Input Cost Element Changes (-6) for pass associated with preceding 07 card.
15. Sensitivity Element Change Count (07) for next pass, if any, in which elements are changed, and associated Sensitivity Input Cost Element Changes (-6).
16. 07 and -6 cards for any additional passes of second run.
17. Pass Cards (05) for all passes in second run.
18. Data organized by items 10 through 17 for each additional sensitivity run; there is no practical limit to the number of sensitivity runs which can be made.
19. If another system is to be processed, the data for the next system is organized by items 2 through 18, thus requiring as input its separate set of Parameter Cards (02) and Factor and Percentage Values (03). As many different systems may be processed as desired.

This data organization is shown graphically in Fig. 8 for a single system with multi-passes and multi-runs.

The identification code for Columns 73-80 has been developed to permit the data cards to be arranged by sorting off-line on Columns 73 to 80. The code for the various card types is shown in Table 3.

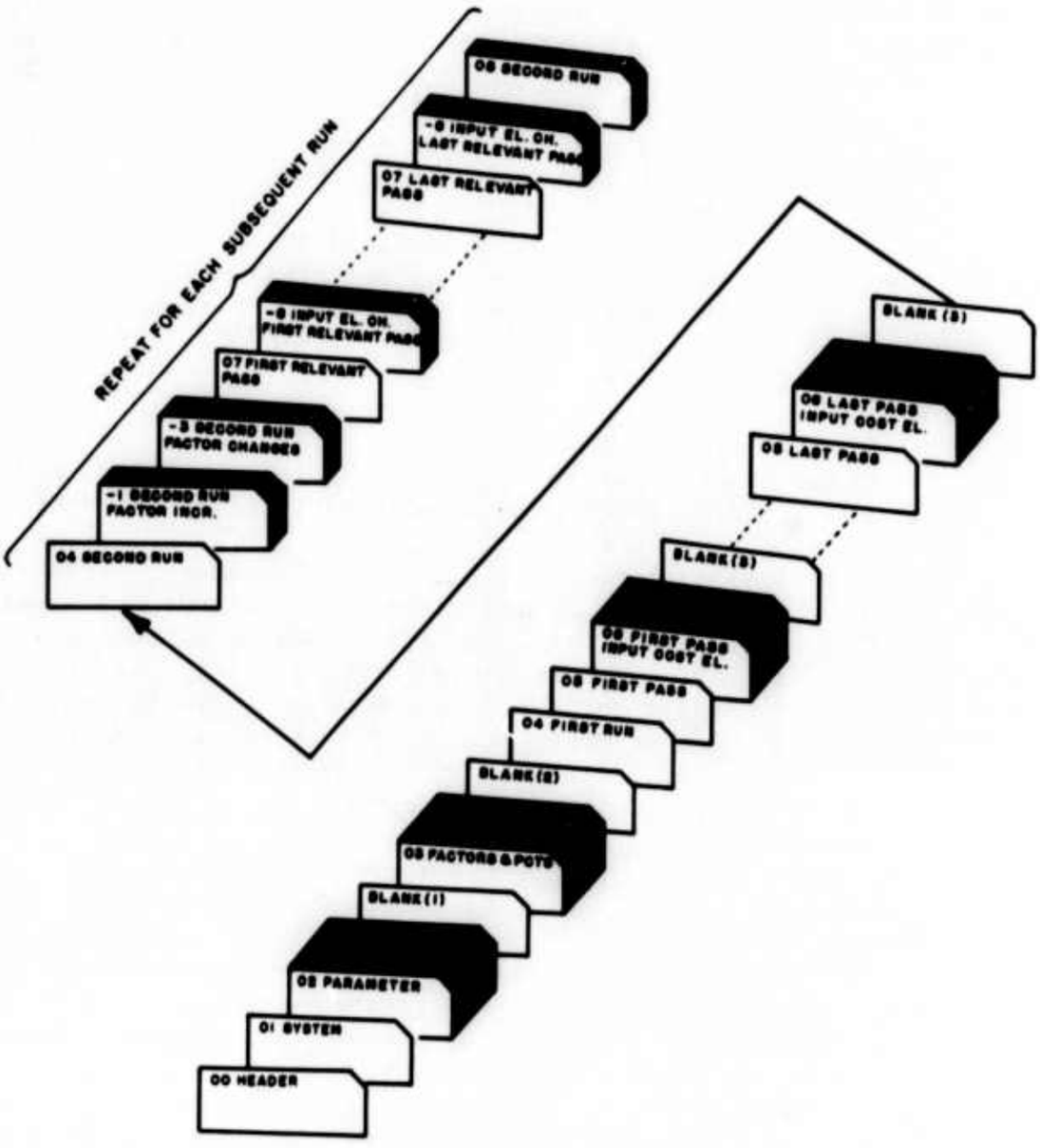

Fig. 8. Data Organization: Single System Multi-Pass and Multi-Run

Table 3

Identification Codes

Card Type	Card Col. → 73 Name → System	74-75 Run	76-77 Pass	78-80 Sort Code
00	0	00	00	000
01	X	00	00	001
02	X	00	00	002
Blank (1)	X	00	00	003
03	X	00	00	004
Blank (2)	X	00	00	005
04	X	YY	00	000
05	X	YY	WW	000
06	X	YY	ZZ	101 to 998
Blank (3)	X	YY	ZZ	999
07	X	YY	ZZ	007
-1	X	YY	00	001
-3	X	YY	00	004
-6	X	YY	ZZ	101 to 998

Key: X = System Code

YY = Run Number

ZZ = Pass Number

WW = ZZ for Passes in First Run

= ZZ + 50 for Passes in Subsequent Runs.

Fifty is added to the pass number to put 05 cards at the end of the data deck for subsequent runs, e.g., passes 1 and 2 are coded as 01 and 02 for the first run, and as 51 and 52 for all runs after the first. This coding is applicable only for the identification in Columns 76-77 in the pass cards (05).

A program has been prepared for listing the input data on the IBM 1401 computer after it has been key punched and sorted. The listing is examined for clerical and key punch errors before insertion with the computer programs for processing on the IBM 7090 computer. Page and card code headings facilitate the editing. Exhibit 4, page 111, is an example of the formats on the 1401 listing. Section 4.6.2 discusses types of errors which may be discovered by examining the 1401 listing.

4.3 Table Tape

Data associated with the generation of the output tables are prestored on a magnetic tape. Such storage is adequate since these tables are standard and hence seldom need modification. Data stored include elements similar to 06 cards for the output tables A through E, and nomenclature for all output tables and the structure.

The output tables are generated in the same manner as the cost structure; i.e., the lines in the table are considered as cost elements (06 type) with associated CERs which can generate costs without requiring input data, usually either by totaling other elements or by moving costs from one element to a reference element.

The parameter cards for the table CERs are read with the other 02 cards as data cards, primarily to control the number of times the CERs are used; this is done to assure that usage does not exceed the maximum for each CER and to provide more flexibility in making changes to the structure.

The nomenclature is restricted to thirty-character records and is organized by records to correspond with the elements in the structure and lines in the tables. Blank records are inserted whenever blank spaces are required in the tables to improve the table appearance.

Changes in nomenclature can be made by replacing the appropriate records with the desired nomenclature in the deck of cards used to generate the Table Tape; the nomenclature is punched in columns 1 through 30. A new tape is then created from the modified deck of cards.

4.4 CER Utilization

To use efficiently and correctly the CERs available in the model, it is necessary to know how many of each type of CER are available to the analyst for any changes or additions he may desire to make. This information is obtained from Table 4 which contains, for each CER, the maximum number provided and the number currently in use by the model. The number available is actually greater than the difference between the maximum number provided and the number currently in use since many of the CERs currently in use are not required for any particular cost estimate. If temporary changes to the structure are contemplated for a system cost analysis, a tally on the number

Table 4

CER Utilization

CER #	CER Name	No. of Param.	No. of 06 Cards	Max. No. Avail.	No. Currently In Use
00	No Operation	0	1	No Limit	-
01	Direct Dollars	0	1	No Limit	-
02	Total of 2	2	1	60	54
03	Total of 3	3	1	45	41
04	Total of 4	4	1	30	26
05	Total of 5	5	1	20	17
06	Total of 6	6	1	6	4
07	Total of 7	7	1	3	0
08	Total of 8	8	1	3	0
09	Total of 9	9	1	5	2
10	Total of 10	10	1	10	7
11	Percent Direct (1)	2	1	50	41
12	Percent Direct (2)	3	1	10	7
13	Percent Spread (1)	2	1	35	29
14	Percent Spread (3)	4	1	3	1
15	Percent Operations (1)	2	1	20	14
16	Factor (1)	1	1	20	18
17	Factor (2)	2	2	30	22
18	Factor (3)	3	3	10	7
19	Percent Spread Special	1	2	5	2
20	Factor (1) + Direct Special	1	3	5	3
21	Factor (2) + Direct Special	8	4	4	2
22	Factor (4) + Percent Spread	6	5	7	5
23	Factor (4) + Direct Special	10	6	4	2
24	Multiple Direct	0	4	No Limit	-
25	Multiple Percent Spread	7	4	3	1
26	Move	1	1	100	63
27	Factor (2) + Direct	2	3	10	5
28	Subtract (1)	2	1	5	2
29	Subtract (2)	3	1	5	5
30	Subtract (3)	4	1	5	1
31	Subtract (2) (c)	3	1	3	1
32	Unassigned	4	-	3	-
33	Total of 4 Minus 1	5	1	3	2
34	Unassigned	6	-	3	-
35	Unassigned	7	-	3	-
99	Subsystem Suppression	0	1	No Limit	-

of times new CERs are added should be kept to assure the maximums are not violated. If the maximum number is to be exceeded, a check should be made to determine if any of the number currently in use are not required for the particular system costing study. The parameter cards for CERs which are not required may be replaced with cards containing the appropriate values for the needed CERs. If it is not possible to replace any of the CERs, it may be possible to calculate the desired cost from a different type of CER by setting appropriate values on the input cost element data cards to zero or by changing the associated parameter card to call a zero-cost element, i.e., an element for which costs are never estimated in the particular system costing study. Some examples of CERs which can be created from other CERs are shown in Table 5. It is necessary to create or modify parameter cards for every new CER generated or changed.

Calculations somewhat different from those available in the current set of CERs are obtainable by setting appropriate input cost element data cards to zero and letting the non-zero cards represent resources other than those shown on the input cost element sheets. In such cases, parameter cards must be changed to specify new or different cost factors or percentages. For example, a "Factor (4)" CER, which would require four input cards, can be created by using CER 22 (Factor (4) + Percent Spread) or CER 23 (Factor (4) + Direct Special). If CER 22 were used, a fifth card is still required, but fields ten through twenty-two are left blank. Similarly, if CER 23 were used, fields ten through twenty-two of the required fifth and sixth cards are left blank. Other mixtures of factors, percentages and direct dollars may be obtained by similar manipulations.

A separate set of parameter cards should be used with each system processing to maintain control over changes and to assure that the structure reverts to the basic structure for the next system costing problem.

4.5 Structure Modification

Since considerable design effort has been expended on creating a generalized structure which is applicable to most systems being costed, and since even small changes to key elements may affect many other elements and the output tables, it is strongly urged that the standard structure and output table formats be used whenever possible. The nomenclature of the structure or output tables may be changed, however, as explained in Section 4.3, without affecting other elements of the computer logic.

If changes must be made to the structure, the type of change which has the smallest effect on the computer operations is the addition of new elements. A tenth subsystem which can contain forty additional elements is available for this purpose. It is recommended that any additions to the nine subsystems be made by setting to zero undesired elements in the basic nine-subsystem structure and adding new elements to the tenth subsystem. For each element that is added, a parameter card (02) must also be provided for the associated CER and care must be exercised to assure that the maximum number of times that the CER is used has not been exceeded. Sort codes can be assigned which will assure that the cards are entered into the deck for efficient processing.

Table 5

CERs Obtainable from Other CERs

Desired CER		CER From Which Obtainable	
CER #	CER Name	CER #	CER Name
02-09	Totals 2 through 9	03-10	Totals 3 through 10
11	Percent Direct (1)	12	Percent Direct (2)
13	Percent Spread (1)	14	Percent Spread (3) or
		22	Factor (4) + Percent Spread
16	Factor (1)	17-18	Factor (2) and (3)
		20-23,27	Factors Plus Others
17	Factor (2)	18	Factor (3)
		21-23,27	Factors Plus Others
18	Factor (3)	22, 23	Factors Plus Others
21	Factor (2) + Direct Special	23	Factor (4) + Direct Special
28	Subtract (1)	29, 30	Subtract (2) and (3)
29	Subtract (2)	30	Subtract (3)

When elements are added, the parameter cards for some elements in the original structure should also be changed in order to logically integrate the new elements into the structure. For example, were it desired to subdivide Data for data-processing prime equipment, element number 21220, into "Central Computer Data" and "Peripheral Equipment Data," two elements (Sequence numbers 1261 and 1262) would be added to the tenth subsystem and the CER for element 21220 would be changed from 1302, Percent Spread, to 0255, Total 2. A new parameter card for element 21220 would be created having as parameters sequence numbers 1261 and 1262; this card would be added to the parameter deck and the old 02 card for CER 1302 deleted from the deck. By effecting the changes in the above manner, no change in the generation of output Table B is required. If, however, one had decided to consider element 21220 as Central Computer Data and added one element, Peripheral Equipment Data, then the mission equipment and AGE Data entry in Table B would be in error without changes to the 06 card for that table element on the Table Tape.

Exhibit 5, pages 118 to 131, provides a rapid method for determining the implications of such changes to the structure or output tables. This table is organized by subsystem and may be considered a "Used-On Table." The first column for each subsystem or table lists all the elements in the subsystem or output table and the second column lists the elements in the structure or output tables which reference the particular element in the first column. Therefore, if one desires to replace an element with a different one, it is important to consider the effect on the elements in the second column.

4.6 Error Checks

After data sheets have been prepared, specified error checks should be made. These include examination of the input sheets prior to key punching and the 1401 listing after key punching and sorting (but prior to submission for computer processing). Section 4.6.1 discusses the types of checks to be made prior to key punching, while Section 4.6.2 lists some of the checks to be made after key punching and sorting. The last section (4.6.3) details the errors which will be detected by the computer if they are not discovered by manual examination. A fourth class of errors, those made by the analyst in generating the original input data, must be detected by the analyst himself when examining the output tables for reasonableness prior to submission to the customer.

4.6.1 Checks Before Key Punching

Cost Model Work Sheets #1 and #2 should be carefully examined while the information is being transferred to key punch sheets. Also, the Input Cost Element Estimate Sheets should be scrutinized for possible omissions and errors before submission for key punching.

Some of the possible checks which can be made on the work sheets are:

(1) The tables desired are sufficiently specified;
(2) The number of runs specified corresponds with the number of runs resulting from incremental changes or from changes in elements or factors;
(3) The correct numbers of run and pass cards are present, especially when the incremental feature of the sensitivity analysis is being used.

Some of the items which should be checked on the Input Cost Element Estimate sheets are:

(1) Checks are present in field one for cards which are to be key punched;
(2) Each element is calculated from only one CER;
(3) All the cards associated with a CER are key punched, provided no "7" is entered in the Y column;
(4) Additional cards are inserted in the first run if required by subsequent runs;
(5) The entries for the Percent Spread CERs (13) and (14) add to 1, or less than 1, if Prior Years Total is in dollars;
(6) All entries in fields 12 through 22 are right justified;
(7) The scale factors in the Y and Z columns are reasonable;
(8) The input format is correctly completed for any new element, an associated parameter card (02) has been completed, all effects on other elements have been considered, and the CER does not exceed the maximum number allowed.

4.6.2 Checks After Key Punching (1401 Listing)

A careful check should be made of the key punched input data before submission to the computer for processing. The 1401 listing (Exhibit 4) is provided to facilitate this checking and to provide a record of the input data. A list of possible checks that could be made are listed below. Prior to the detailed examination of the input listing, a check should be made of the Card Codes (Col. 1-2) to assure that the data are organized properly. A careful check of the listing should cover at least the following points:

Card Type	Type of Check
00	Listing against work sheet
01	1) Listing against work sheet 2) Number of elements in subsystem agrees with number key punched

Card Type	Type of Check
02	1) No CER used more times than the maximum permitted. 2) Number of parameters required are present.
03	Proper format for values
04	1) Correct columns key punched 2) Proper count of changes against number of -1, -3, -6 cards 3) As many 04 cards as 01 card specifies, including those required by incremental changes.
05	1) Listing against work sheet 2) Complete set for each sensitivity run.
06	1) No "8" or "9" digits in budget and subsystem fields. 2) Number of cards required for each element are present and in the proper order. If a "7" is in field "Y", only <u>one</u> card is normally required by the CER. 3) Key punching in fields 12 through 22 in proper columns (using a special template developed for this purpose).
07	Correct number of -6 cards follow.
-1	Proper format for value and number of increments
-3	Proper format for value.
-6	Same as 06, plus: the number of cards for each element does not exceed the number of 06 cards used in the original run.

4.6.3 Computer Error Diagnostics

A set of error diagnostics has been programmed into the cost model to check the card codes of input data cards for expected types of cards, and also to check data on various cards for validity. In addition, checks are made to assure that calculations can be performed. These checks still do not guarantee that the output from the model is what the analyst intended. However, they do provide a further check on, and identify, possible errors in input card organization and key punching. The errors found by these checks are identified by diagnostic print outs listed in Table 6 which shows the print out and the reason for it, the computer subroutine which performs the check, and a brief description of what happens after the error is found.

TABLE 6

LIST OF DIAGNOSTIC PRINT OUTS AND COMPUTER ACTION

DIAGNOSTIC PRINT OUT	REASON	SUBROUTINE	COMPUTER ACTION
INCORRECT HEADER CARD - cc*	No 00 Card	EXEC	Stop by Diagnostic Check
INCORRECT SYSTEM CARD - cc, Relative Sys. #	No 01 Card	EXEC	Stop by Diagnostic Check
INCORRECT RUN CARD - cc, Relative Sys. #, Run #	No 04 Card	EXEC	Stop by Diagnostic Check
INCORRECT PASS CARD - cc, Relative Sys. #, Run #, Pass #	No 05 Card	EXEC	Stop by Diagnostic Check
INCORRECT PARAMETER CARD Card Columns 1-72 in 02 Format	Illegal Ref. El or Param. #	PARAM	Stop by Diagnostic Check
INCORRECT FACTOR & PERCENTAGE CARD - cc	No 03 Card	INFAP	Stop by Diagnostic Check
CAPACITY OF INCREMENTAL TABLE HAS BEEN EXCEEDED	More than 50 Incr. in Incr. Table	SENSE	Stops Immediately
INCORRECT INCREMENTAL CARD - cc	No -1 Card	SENSE	Stops Immediately
INCORRECT FACTOR & PERCENTAGE CARD - cc	No -3 Card	SENSE	Stops Immediately
CAPACITY OF TABLE FOR REVISED DATA HAS BEEN EXCEEDED	More than 50 Input Cost Element Changes	SENSE	Stops Immediately
INCORRECT REVISED DATA CARD - cc	No -6 Card	SENSE	Stops Immediately
INCORRECT HEADER CARD FOR REVISED DATA - cc	No 07 Card	SENSE	Stops Immediately
Card Columns 1-72 in 06 Format and "1"	No 06 Card	SANDS	Stop by Diagnostic Check
Card Columns 1-72 in 06 Format and "2"	1st Card of an Element is Missing	SANDS	Stop by Diagnostic Check

*cc denotes incorrect card code

TABLE 6 (Cont'd)

DIAGNOSTIC PRINT OUT	REASON	SUBROUTINE	COMPUTER ACTION
Card Columns 1-72 in 06 Format and "3"	06 Cards for an Element Out of Sequence	SANDS	Stop by Diagnostic Check
ATTEMPT TO ADD NEW ELEMENT Card Columns 1-72 in 06 Format	-6 Card has Sequence No. Not in 1st Run	INCORP	Stop by Diagnostic Check
ATTEMPT TO ADD EXTRA CARD FOR ELEMENT Card Columns 1-72 in 06 Format	-6 Card Has Card # (Field 7) Higher Than Highest # in First Run	INCORP	Stop by Diagnostic Check
CER NO INCORRECT FOR ELEMENT Card Columns 1-72 in 06 Format	Sequence No. of 06 and 02 Cards Don't Match	ITER	Stops Immediately
THE FOLLOWING ELEMENTS COULD NOT BE CALCULATED - Sequence #'s	No Element Can be Calculated in an Iteration Through Auxiliary List	ITER	Prints Structure as Calculated and Stops
MORE THAN 100 ELEMENTS COULD NOT BE CALCULATED - Prints First 100 Sequence #'s in List	Auxiliary List Contains More Than 100 Elements	ITER	Prints Structure as Calculated and Stops
SUM OF PERCENTAGES = X.XX, SUM SHOULD EQUAL 1. Card Columns 1-72 in 06 Format	Sum of Pcts Not Equal to 1	PCT SPREAD	Continues
SUM OF PERCENTAGES = X.XX, SUM SHOULD BE LESS THAN ONE. Card Columns 1-72 in 06 Format	Sum of Pcts Not Less Than 1	PCT SPREAD	Continues
INCORRECT ELEMENT CODE	Illegal Ref. Element	STORE	Continues

Since it is desirable to check as much input data as possible before stopping, the computer program creates a signal when a diagnostic print out is made and usually continues reading data until it reaches the diagnostic check which is just prior to entry to subroutine ITER (see Fig. 9 in Section 5). This stop is called "Stop by Diagnostic Check" in the "Computer Action" column of Table 6. For example, errors which have occurred before the input element cards (06) of the first pass of the first run have been read will not cause the computer to stop until it has processed all the "06" cards of the first pass of the first run. A check is then made to determine if any diagnostic print outs have been made; if so, the computer stops. For errors in input data after the first pass of the first run, the program continues reading and processing data until it returns to the diagnostic check in the computer program. The amount of data read in and processed prior to returning to this point can be determined from Fig. 9, the general computer flow chart.

The "cc" in the Diagnostic Print Out column of Table 6 is the "incorrect" card code for the card actually read.

The number of incremental factor changes and the number of input cost element card changes for a run are each limited to fifty. If these limits are exceeded, diagnostics are printed and the computer stops immediately.

5.0 COMPUTER PROGRAMS

This chapter gives a brief description of the cost model computer program. The computer program consists of an executive routine which controls, via subroutines, the processing of the various types of input data, the computation of costs for the structure, and the generation and printing of output tables. Figure 9, a general flow chart for the cost model, shows when each major subroutine is used by the executive routine. The subroutines are described in Sections 5.1, 5.2, 5.3: Input, Computation, and Output, respectively. Program specifications are outlined in Section 5.4.

5.1 Input Subroutines

Five major subroutines used to read in the different types of input data are described below, along with the read controls for each of the eleven types of input cards.

5.1.1 PARAM

The subroutine PARAM reads in parameter cards (02), and converts the relative parameter addresses on the cards to absolute machine addresses. Then, under control of the CER No. and CER line No., it stores the sequence number of the element to be calculated and the converted addresses.

5.1.2 INFAP

The subroutine INFAP reads in initial values for factors and percentages from 03 cards and writes them on magnetic tape 8. Thus, these initial values are available for use in subsequent runs in sensitivity analysis.

5.1.3 SANDS

The subroutine SANDS is entered in the first run only. It reads in the original input cost element data (06) for a pass, scales the data, sequence checks the card number of elements with multi-card inputs, and writes the data on magnetic tape 8. The data are thus available for recall for use in subsequent runs.

SANDS calls a FAP subroutine, UNPAC, which unpacks the card number and the scaling factors Y and Z, all of which have been read in as a single field in octal code by subroutine SANDS.

5.1.4 SENSE

The subroutine SENSE is entered for all runs. In the first run, it initializes storage locations for sensitivity analysis. In subsequent runs, it reads from magnetic tape 8 the initial set of factors and percentages

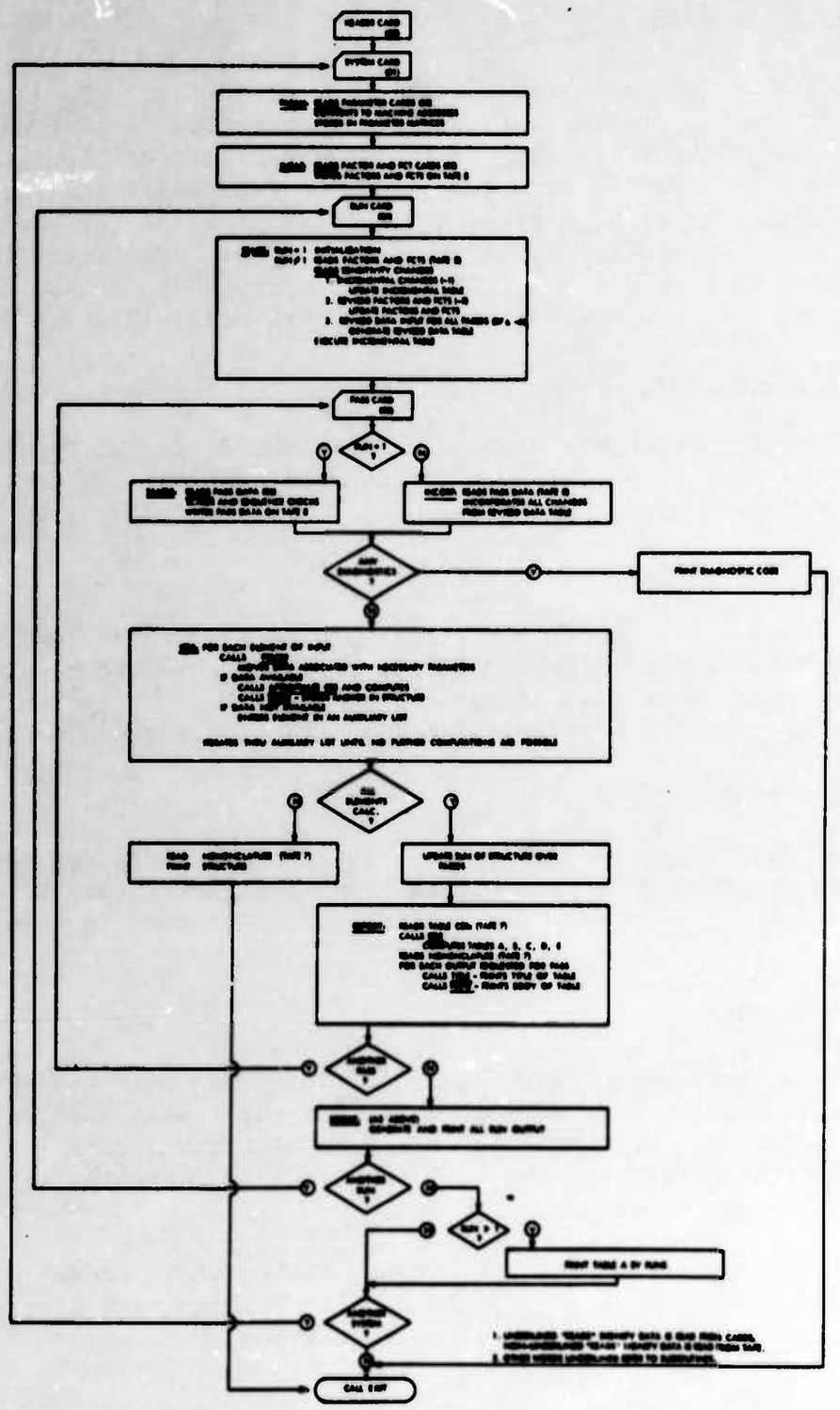

Fig. 9 General Flow Chart for Cost Model

and checks for the three possible types of sensitivity changes. If new -1 cards are present, it enlarges the incremental table developed for this purpose. It checks for revised factors and percentages (-3 cards) and replaces old values with new ones. It then looks for changes in input data elements, and if there are any, it records the pass number, reads and scales new data, and stores the data in a revised read area, the storage area for changing input data elements. It then examines the incremental table and makes appropriate changes to the factors and percentages.

5.1.5 INCORP

The subroutine INCORP is entered only in sensitivity runs, i.e., in all runs after the first. It reads the original input data for a pass from magnetic tape and searches the revised read area for appropriate input data element sensitivity changes for the particular pass being processed. If a pass number match is found, it then searches the original data to match the element revised and replaces the original data with the revised data. The searches and matches continue until all changed input data have been incorporated.

5.1.6 Controls on Card Reading

Various card reading controls have been established because of the multiplicity of card formats for the input data cards; they are:

Header Cards (00) - one card.

System Cards (01) - one card per system; the total number controlled by the number of systems specified in the header card.

Parameter Cards (02) - terminated by a blank card.

Factor and Percentage Value Cards (03) - terminated by a blank card.

Run Cards (04) - one card at a time; the total number controlled by the number of runs specified in the system card.

Pass Cards (05) - one card; the total number controlled by the number of passes per run specified in the system card.

Input Cost Element Estimate Cards (06) - terminated by a blank card.

Sensitivity Element Change Count Cards (07) - one card at a time; the total number of 07 cards for a run is controlled by comparing the total number of element changes specified on the run card with the sum of element changes specified on processed 07 cards for the earlier passes of the run. When the sum of -7 cards processed equals the total on the run card, no additional 07 cards are expected for that run.

Sensitivity Factor and Percentage Increment Cards (-1) - the number controlled by the number of factorsand percentages incrementally modified as specified on the run card.

Sensitivity Factor and Percentage Change Cards (-3) - the number controlled by the number of changes specified on the run card.

Sensitivity Input Cost Element Changes (-6) - controlled by the number of revisions per pass specified on the 07 card.

The general logic of the card organization and the points where read control is exercised are shown in Fig. 10.

5.2 Computation Subroutines

Subroutine ITER may be considered as the executive routine for controlling the calculation of costs. The logic of the subroutine is such that the computer iterates through the elements, calculating and storing costs until either all the elements have been calculated or no additional elements can be calculated during an iteration.

To calculate the cost of an element, the subroutine PRECER is called to move data associated with necessary parameters to a working area. If the necessary data are not available, the element number is stored in an auxiliary list for later iterations. The appropriate CER formula is then used to calculate costs and subroutine STORE stores the results.

Twelve basic subroutines are used by the current CERs and table generators to compute costs; additional CERs can be established from this basic set.

5.3 Output Subroutines

Subroutine REPORT may be considered the executive routine for controlling the preparation of tables. Since the entries in the tables are calculated in the same fashion as the elements of the structure, a set of CERs has been prepared for generating the standard tables. These are stored on the Table Tape. REPORT reads the Table Tape to obtain these CERs, then uses subroutine ITER to control the calculations of the standard tables. The nomenclature for the tables and the structure is then read from the Table Tape and, for each table specified by the run and pass control cards, the title and the body of the table are printed by subroutines TITLE and PRINT, respectively.

The REPORT subroutine is used to generate tables both for a pass and, after all passes have been completed, over passes for a run.

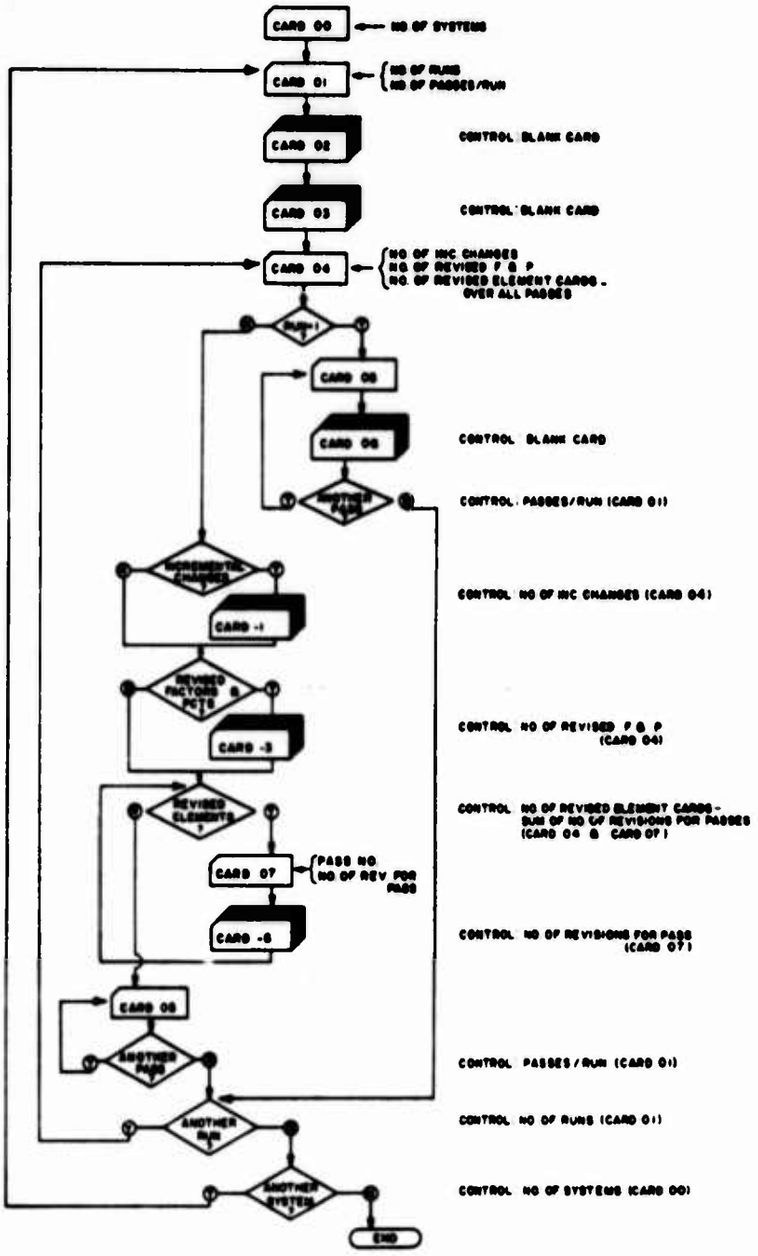

Fig. 10 Cost Model Data Organization

5.4 Program Specifications

The computer programs have been written in FORTRAN, except for three FAP subroutines. The input data is read from Tape 2 while the output is placed on Tape 3. Tape 7 contains the Table Tape while Tapes 6 and 8 are used as scratch tapes for storing the input data and intermediate calculations for use in sensitivity runs. The computer programs and tables occupy about 7400 core storage locations for instructions and 22,000 words for common data for a total of 29,400 out of the total 32,768 core storage registers in the 7090.

T. J. Jannsen

H. Glazer

J. C. Des Roches

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APPENDIX A

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EXHIBIT 1

INPUT DATA SHEETS

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Major References in Text - Sections 2.4, 3.1, 4.1

ANALYST _____ DATE _____

INPUT COST ELEMENT ESTIMATES

SYSTEM NO. 1 PASS NO. 1 RUN NO. _____

FIELD # 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
E	T	ELEMENT NAME & NUMBER	SOG. NO.	SUB. CODE	USUAL COST #	CARD #	UNIT OF MEASURE	DEFOG. ELEM. #	Y	Z	PRIOR TOTAL	YEARS N	N+1	N+2	N+3	N+4	N+5	N+6	N+7	N+8	N+9	SORT CODE
✓	06	SYSTEM 10000	1001	6	0301	1	*TOTAL															901
✓	06	SYSTEM DESIGN 11000	1002	6	1001	1	MAN YRS--AF OFFICERS		2	2												901
✓	06					2	MAN YRS--AF CIV															902
✓	06					3	MAN YRS--CONT. ENG.		2	2												903
✓	06	SYSTEM INTEG, TEST & EVAL 12000	1003	6	0301	1	*TOTAL															942
✓	06	INTEGRATION OF SUBSYSTEMS 12100	1004	6	2201	1	MAN YRS--AF OFFICERS		2	2												916
✓	06					2	MAN YRS--AF CIV															917
✓	06					3	MAN YRS--CONT. ENG.															918
✓	06					4	MAN YRS--CONT. TECH.															919
✓	06					5	DOLLARS--MATERIALS															920
✓	06					6	MONTHS TESTING	(1)	1													921
✓	06		1004	6	0401	OR 1	*TOTAL															922
✓	06	INTRA-SYSTEM ENGINEERING 12110	1005	6	1002	1	MAN YRS--AF OFFICERS															924
	06					2	MAN YRS--AF CIV															925
	06					3	MAN YRS--CONT. ENG.															926
✓	06	INTRA-SYS TEST PLANNING 12120	1006	6	1701	1	MAN YRS--CONT. ENG.															907
	06					2	MAN YRS--CONT. TECH.															908
✓	06	INTRA-SYS INTEG TESTS 12130	1007	6	2101	1	MAN YRS--CONT. ENG.		2													909
	06					2	MAN YRS--CONT. TECH.															910
	06					3	DOLLARS--TEST EQUIP.															911
	06					4	MONTHS TESTING	(1)														912
✓	06	INTRA-SYS DATA REDUCTION 12140	1008	6	1003	1	MAN YRS--CONT. ENG.		2													913
	06					2	MAN YRS--CONT. TECH.															934
	06					3	COMPUTER HOURS															935
	06	INTEGRATION WITH ENVIR SYS 12200	1009	6	2302	1	MAN YRS--AF OFFICERS															928
	06					2	MAN YRS--AF CIV															936
	06					3	MAN YRS--CONT. ENG.															937
	06					4	MAN YRS--CONT. TECH.															938
	06					5	DOLLARS--MATERIALS															939
	06					6	MONTHS TESTING	(1)														940
	06		1009	6	0402	OR 1	*TOTAL															941
✓	06	INTER-SYSTEM ENGINEERING 12210	1010	6	1004	1	MAN YRS--AF OFFICERS		2	2												923
✓	06					2	MAN YRS--AF CIV		2													924
✓	06					3	MAN YRS--CONT. ENG.															925
✓	06	INTER-SYS TEST PLANNING 12220	1011	6	1702	1	MAN YRS--CONT. ENG.															926
✓	06					2	MAN YRS--CONT. TECH.															927
✓	06	INTER-SYSTEM INTEG TESTS 12230	1012	6	2102	1	MAN YRS--CONT. ENG.															928
✓	06					2	MAN YRS--CONT. TECH.															929
✓	06					3	DOLLARS--TEST EQUIP.															930
✓	06					4	MONTHS TESTING	(1)														931
✓	06	INTER-SYS DATA REDUCTION 12240	1013	6	1005	1	MAN YRS--CONT. ENG.															932
✓	06					2	MAN YRS--CONT. TECH.															933
✓	06					3	COMPUTER HOURS															936
✓	06	SYSTEM MANAGEMENT 13000	1014	6	1201	1	*% DIRECT	(2)														949
	06		1014	6	0202	OR 1	*TOTAL															950
✓	06	ADMINISTRATIVE CONTROL 13100	1015	6	1006	1	MAN YRS--AF OFFICERS															943
	06					2	MAN YRS--AF CIV															944
	06					3	MAN YRS--CONT. ADMIN															945
✓	06	TECHNICAL CONTROL 13200	1016	6	1007	1	MAN YRS--AF OFFICERS		1													946
	06					2	MAN YRS--AF CIV															947
	06					3	MAN YRS--CONT. ENG.															948
	06																					
	06	(1) 20000 + 30200 + 40200 + 52200 + 62200																				
	06	(2) 12000 + 13000																				

NCP 1000b

* - Indicates that no "Years" data is required.
E - Check this column if line is to be key punched.
T - Card Code for type of card.
Y - Scale Factor for Years Data - Dollar Estimates - exponent of 0-6, for example 6 represents $ x 10^6.
Indirect Estimates - number of decimal places in the data, for example 2 represents # x 10^{-2}
Z - 0-6 if prior years total is given in dollars, the digit representing the exponent.
7 if prior years total is given in other unit of measure.

ANALYST _____ DATE 6/17/63

INPUT COST ELEMENT ESTIMATES

SYSTEM NO. SAMPLE PASS NO. 1 RUN NO. 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
												YEARS										
*	T	ELEMENT NAME & NUMBER	SUB. NO.	SUB. CODE	VERBAL CODE	CARD #	UNIT OF MEASURE	SPECIAL CLASS. #	V	Z	PRIOR TOTAL	N	N+1	N+2	N+3	N+4	N+5	N+6	N+7	N+8	N+9	COST CODE
	05	[illegible]	[illegible]	1017	0	0202	1	*TOTAL														145
	05	[illegible]	[illegible]	1018	0	0203	1	*TOTAL														126
	05	[illegible]	[illegible]	1019	6	1201	1	$ SPREAD	[illegible]													121
	05			1019	6	0204	OR 1	*TOTAL														122
	05	[illegible]	[illegible]	1020	6	1703	1	MAN YRS-CONST. ENG.		0		X	X									112
	05						2	MAN YRS-CONT. TECH.		1		X	X									113
	05	[illegible]	[illegible]	1021	6	0303	1	*TOTAL														118
	05	[illegible]	[illegible]	1022	6	2701	1	MAN YRS-CONT. ENG.														114
	05						2	MAN YRS-CONT. TECH.														115
	05						3	DOLLARS-MATERIALS		3		XXX	XXX									116
	05	[illegible]	[illegible]	1023	6	1101	1	*$ DIRECT	[illegible]													117
	05	[illegible]	[illegible]	1024	6	1704	1	MAN YRS-CONT. ENG.		0		X	X									119
	05						2	MAN YRS-CONT. TECH.		1		X	X									120
	05	[illegible]	[illegible]	1025	0	0403	1	*TOTAL														111
	05	[illegible]	[illegible]	1026	7	0304	1	*TOTAL														102
	05	[illegible]	[illegible]	1027	7	0101	1	DOLLARS		4		XXX	XXX	XXX								101
	05	[illegible]	[illegible]	1028	7	0102	1	DOLLARS		3		XXX										103
	05	[illegible]	[illegible]	1029	7	1202	1	$ SPREAD	[illegible]	2		X	X	X								104
	05	[illegible]	[illegible]	1030	7	1203	1	$ SPREAD	[illegible]	2		X	X	X								105
	05	[illegible]	[illegible]	1031	4	2201	1	MAN YRS-AF OFFICERS		0		X	X	X								106
	05						2	MAN YRS-AF ENLIST		0		X	X	X								107
	05						3	MAN YRS-CONT. ENG.		0		X	X	X								108
	05						4	MAN YRS-CONT. TECH.		0		X	X	X								109
	05						5	$ SPREAD-MAT. & SPARES	[illegible]	2		X	X	X								110
	05	[illegible]	[illegible]	1032	7	0305	1	*TOTAL														128
	05	[illegible]	[illegible]	1033	7	1204	1	$ SPREAD	[illegible]	2			X	X	X							123
	05	[illegible]	[illegible]	1034	7	1205	1	$ SPREAD	[illegible]	2			X	X	X							124
	05	[illegible]	[illegible]	1035	0	0305	1	*TOTAL														116
	05	[illegible]	[illegible]	1036	6	1102	1	*$ DIRECT	[illegible]													127
	05	[illegible]	[illegible]	1037	0	1142	1	*$ DIRECT	[illegible]													132
	05			1037	0	0404	OR 1	*TOTAL														133
	05	[illegible]	[illegible]	1038	7	1103	1	*$ DIRECT	[illegible]													125
	05	[illegible]	[illegible]	1039	7	1104	1	*$ DIRECT	[illegible]													129
	05	[illegible]	[illegible]	1040	7	1105	1	*$ DIRECT	[illegible]													130
	05	[illegible]	[illegible]	1041	4	1106	1	*$ DIRECT	[illegible]													131
	05	[illegible]	[illegible]	1042	7	1107	1	*$ DIRECT	[illegible]													134
	05	[illegible]	[illegible]	1043	4	0206	1	*TOTAL														144
	05	[illegible]	[illegible]	1044	4	0405	1	*TOTAL														140
	05	[illegible]	[illegible]	1045	4	1201	1	$ OPERATING	[illegible]	2				X	XX	XXX	XXX	XXX	XXX	XXX		136
	05	[illegible]	[illegible]	1046	4	1108	1	*$ DIRECT	[illegible]													137
	05	[illegible]	[illegible]	1047	4	1202	1	$ OPERATING	[illegible]	7												138
	05	[illegible]	[illegible]	1048	4	0103	1	DOLLARS		7												139
	05	[illegible]	[illegible]	1049	4	0104	1	DOLLARS		7												143
	05																					

* – Indicates that an "Years" data is required.
Z – Check this column if item is to be key punched.
T – Card Code for type of card.
V – Scale Factor for Years Data – Dollar Estimates – exponent of 0-6, for example 4 represents $ \times 10^4$
Indirect Estimates – number of decimal places in the data; for example 3 represents $\times 10^{-3}$
Z – 0-6 if prior years total is given in dollars, the digit representing the exponent.
7 if prior years total is given in other unit of measure.

INPUT COST ELEMENT ESTIMATES

ANALYST _____ DATE 6/7/66 SYSTEM NO. 41 PASS NO. _____ RUN NO. 1

TABLE 1	TABLE 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
												YEARS										
R	T	ELEMENT NAME & NUMBER	SEQ. NO.	SUB. CODE	INITIAL CER #	CARD #	UNIT OF MEASURE	SPREAD ELEM. #	V	Z	PRIOR TOTAL	N	N+1	N+2	N+3	N+4	N+5	N+6	N+7	N+8	N+9	SORT CODE
	06	DATA PROCESSING SUBSYSTEM 30000	1050	0	0306	1	*TOTAL															205
	06	SENSOR EQUIPMENT 30000	1051	0	0307	1	*TOTAL															206
	06	DEVELOPMENT, TEST, & EVAL 31000	1052	6	1306	1	% SPREAD	30000														221
	06		1052	6	0308	OR 1	*TOTAL															222
	06	ANALYSIS & DESIGN 31110	1053	6	1705	1	MAN YRS--CONT. ENG.		1													212
	06					2	MAN YRS--CONT. TECH.		2													213
	06	FABRICATION FOR TEST 31120	1054	6	0307	1	*TOTAL															210
	06	MOCKUPS, PROTOS, & OTHER 31121	1055	6	2702	1	MAN YRS--CONT. ENG.															214
	06					2	MAN YRS--CONT. TECH.															215
	06					3	DOLLARS--MATERIALS		3													216
	06	DEV TOOL & TEST EQUIP 31122	1056	6	1109	1	*% DIRECT	31121														217
	06	TEST & EVALUATION 31130	1057	6	1706	1	MAN YRS--CONT. ENG.															219
	06					2	MAN YRS--CONT. TECH.															220
	06	PROCUREMENT & INSTALLATION 31200	1058	0	0406	1	*TOTAL															211
	06	PRIME EQUIPMENT 31210	1059	7	0306	1	*TOTAL															203
	06	SENSOR HARDWARE 31211	1060	7	0105	1	DOLLARS		3													201
	06	SPECIAL TOOLING 31212	1061	7	0106	1	DOLLARS		3													202
	06	DATA 31220	1062	7	1307	1	% SPREAD	31210	2													204
	06	FIRST DESTINATION TRANS 31230	1063	7	1308	1	% SPREAD	31210	2													205
	06	INSTALLATION & CHECKOUT 31240	1064	4	2202	1	MAN YRS--AF OFFICERS		1													206
	06					2	MAN YRS--AF ENLISTED		1													207
	06					3	MAN YRS--CONT. ENG.															208
	06					4	MAN YRS--CONT. TECH.															209
	06					5	% SPREAD--MAT. & SPARES	31210														210
	06	INITIAL SPARES 31300	1066	7	0309	1	*TOTAL															225
	06	SPARES 31310	1066	7	1309	1	% SPREAD	31210	2													223
	06	TRANSPORTATION OF SPARES 31320	1067	7	1310	1	% SPREAD	31310	2													224
	06	AEROSPACE GROUND EQUIP (AGE) 32000	1068	0	0309	1	*TOTAL															235
	06	DEVELOPMENT, TEST, & EVAL 32100	1069	6	1110	1	*% DIRECT	31100														227
	06	PROCUREMENT & INSTALLATION 32200	1070	0	1103	1	*% DIRECT	31200														232
	06		1070	0	0407	OR 1	*TOTAL															233
	06	EQUIPMENT 32110	1071	7	1111	1	*% DIRECT	31210														228
	06	DATA 32120	1072	7	1112	1	*% DIRECT	31220														229
	06	FIRST DESTINATION TRANS 32130	1073	7	1113	1	*% DIRECT	31230														230
	06	INSTALLATION & CHECKOUT 32140	1074	4	1114	1	*% DIRECT	31240														231
	06	INITIAL SPARES 32300	1075	7	1115	1	*% DIRECT	31210														234
	06	REPLACEMENT, MAINT & RENTALS 33000	1076	4	0210	1	*TOTAL															244
	06	MATERIALS & SERVICES 33100	1077	4	0408	1	*TOTAL															240
	06	FOLLOW-ON SPARES 33110	1078	4	1503	1	% OPERATIONS	31210														236
	06	TRANS OF FOLLOW-ON SPARES 33120	1079	4	1116	1	*% DIRECT	33110														237
	06	EQUIPMENT REPLACEMENT 33200	1080	4	1504	1	% OPERATIONS	31210														238
	06	SUBCONTRACT MAINTENANCE 33400	1081	4	0107	1	DOLLARS															239
	06	RENTALS 33500	1082	4	0108	1	DOLLARS															243

UCP 1000x

* – Indicates that no "Years" data is required.
X – Check this column if line is to be key punched.
T – Card Code for type of card.
V – Scale Factor for Years Data – Dollar Estimates – exponent of 8-6; for example 6 represents $ x 10^6
Indirect Estimates – number of decimal places in the data; for example 2 represents # x 10^{-2}
Z – 0-6 if prior years total is given in dollars, the digit representing the exponent.
7 if prior years total is given in other unit of measure.

ANALYST _____ DATE 6/17/63

INPUT COST ELEMENT ESTIMATES

SYSTEM NO. SAMPLE PASS NO. 1 RUN NO. 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
												YEARS										
R	T	ELEMENT CODE & TITLE	SEQ. NO.	SUB-CODE	VISUAL CODE	CARD #	UNIT OF MEASURE	SPECIAL TABLE #	V	Z	PRIOR TOTAL	N	N-1	N-2	N-3	N-4	N-5	N-6	N-7	N-8	N-9	SHORT CODE
	06	COMMUNICATIONS SUBSYSTEM	41000	1003	0	0310	1	*TOTAL														308
	06	RADIO EQUIPMENT	41100	1004	0	0311	1	*TOTAL														320
	06	DEVELOPMENT, TEST, & EVAL	41120	1005	6	1311	1	% SPREAD	41210	7												321
	06			1005	6	0312	OR 1	*TOTAL														322
	06	ANALYSIS & DESIGN	41110	1006	6	1707	1	MAN YRS-CONT. ENG.		7												312
	06						2	MAN YRS-CONT. TECH.														313
	06	FABRICATION FOR TEST	41120	1007	6	0211	1	*TOTAL		7												310
	06	SECURITY, PERSONNEL & OTHERS	41121	1008	6	2703	1	MAN YRS-CONT. ENG.		7												314
	06						2	MAN YRS-CONT. TECH.														315
	06						3	DOLLARS-MATERIALS														316
	06	DEV TOOL & TEST EQUIP	41122	1009	6	1117	1	*% DIRECT	41121	7												317
	06	TEST & EVALUATION	41123	1010	6	1708	1	MAN YRS-CONT. ENG.		7												319
	06						2	MAN YRS-CONT. TECH.														320
	06	PROCUREMENT & INSTALLATION	41200	1011	0	0409	1	*TOTAL														311
	06	FIXED EQUIPMENT	41210	1012	7	0212	1	*TOTAL														303
	06	RADIO HARDWARE	41211	1013	7	0109	1	DOLLARS		3				XXX	XXX							301
	06	SPECIAL TOOLING	41212	1014	7	0110	1	DOLLARS		7												302
	06	DATA	41220	1015	7	1312	1	% SPREAD	41210	7												304
	06	FIXED INSTALLATION TRANS	41230	1016	7	1313	1	% SPREAD	41210	7												305
	06	INSTALLATION & CHECKOUT	41240	1017	4	2203	1	MAN YRS-AF OFFICERS		7												306
	06						2	MAN YRS-AF AIRMEN														307
	06						3	MAN YRS-CONT. ENG.														308
	06						4	MAN YRS-CONT. TECH.														309
	06						5	% SPREAD-MAT. & SPARES	41210													318
	06	INITIAL SPARES	41250	1018	7	0213	1	*TOTAL		7												325
	06	SPARES	41251	1019	7	1314	1	% SPREAD	41250	7												323
	06	TRANSPORTATION OF SPARES	41252	1020	7	1315	1	% SPREAD	41250	7												324
	06	ASSOCIATE GROUND EQUIP (AGE)	42000	1101	0	0313	1	*TOTAL		7												326
	06	DEVELOPMENT, TEST, & EVAL	42100	1102	6	1110	1	*% DIRECT	41120	7												327
	06	PROCUREMENT & INSTALLATION	42200	1103	0	1164	1	*% DIRECT	41220													332
	06			1103	0	0410	OR 1	*TOTAL		7												333
	06	EQUIPMENT	42210	1104	7	1119	1	*% DIRECT	41210	7												328
	06	DATA	42220	1105	7	1120	1	*% DIRECT	41220	7												329
	06	FIXED INSTALLATION TRANS	42230	1106	7	1121	1	*% DIRECT	41230	7												330
	06	INSTALLATION & CHECKOUT	42240	1107	4	1122	1	*% DIRECT	41240	7												331
	06	INITIAL SPARES	42250	1108	7	1123	1	*% DIRECT	41250	7												334
	06	REPLACEMENT, MAINT & RENTALS	43000	1109	4	0214	1	*TOTAL		7												344
	06	MATERIALS & SERVICES	43100	1110	4	0411	1	*TOTAL		7												340
	06	PEACEKEEP SPARES	43110	1111	4	1305	1	% OPERATIONS	43210	7												336
	06	TRANS OF PEACEKEEP SPARES	43120	1112	4	1124	1	*% DIRECT	43110	7												337
	06	EQUIPMENT REPLACEMENT	43130	1113	4	1306	1	% OPERATIONS	43210	7												338
	06	CONTRACTOR MAINTENANCE	43140	1114	4	0111	1	DOLLARS		7												339
	06	SUPPLIES	43200	1115	4	0215	1	*TOTAL														343
	06	LABOR CREDITS	43210	1116	4	0112	1	DOLLARS		6												341
	06	TRANSP EQUIPMENT	43220	1117	4	0113	1	DOLLARS		3												342
	06																					

DCP 10000

* – Indicates that an "Years" data is required.
R – Check this column if line is to be key punched.
T – Card Code for type of card.
V – Scale Factor for Years Data – Dollar Estimates – exponent of 0-6, for example 6 represents 5×10^6
Indirect Estimates – number of decimal places in the data, for example 2 represents 8×10^{-2}
Z – 0-6 if prior years total is given in dollars, the digit representing the exponent.
7 if prior years total is given in other unit of measure.

INPUT COST ELEMENT ESTIMATES

ANALYST _____ DATE _____ SYSTEM NO. _____ PASS NO. _____ RUN NO. _____

LINE 1	LINE 2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
R	T	ELEMENT NAME & NUMBER		SEQ. NO.	BUD. CODE	USUAL CER #	CARD #	UNIT OF MEASURE	DEPEND. ELEM. #	Y	Z	PRIOR TOTAL	YEARS										SPEC. CODE
													N	N-1	N-2	N-3	N-4	N-5	N-6	N-7	N-8	N-9	
	06	DATA ACQUISITION SUBSYSTEM	50000	1118	0	0314	1	*TOTAL															445
	06	MISSION EQUIPMENT	$1000	1119	0	0315	1	*TOTAL															420
	06	DEVELOPMENT, TEST, & EVAL	$1100	1120	6	1316	1	$ SPREAD	$1110														421
	06			1120	6	0316	OR 1	*TOTAL															422
	06	ANALYSIS & DESIGN	$1110	1121	6	1709	1	MAN YRS-CONT. ENG.															412
	06						2	MAN YRS-CONT. TECH.															413
	06	FABRICATION FOR TEST	$1120	1122	6	3216	1	*TOTAL															410
	06	MOCKUPS, PHOTO, & OTHER	$1121	1123	6	2706	1	MAN YRS-CONT. ENG.															414
	06						2	MAN YRS-CONT. TECH															415
	06						3	DOLLARS-MATERIALS															416
	06	DEV TOOL & TEST EQUIP	$1122	1124	6	1125	1	*$ DIRECT	$1121														417
	06	TEST & EVALUATION	$1130	1125	6	1710	1	MAN YRS-CONT. ENG															419
	06						2	MAN YRS-CONT. TECH.															420
	06	PROCUREMENT & INSTALLATION	$1200	1126	0	0412	1	*TOTAL															411
	06	PRIME EQUIPMENT	$1210	1127	7	0217	1	*TOTAL															403
	06	MISSION HARDWARE	$1211	1128	7	0114	1	DOLLARS															401
	06	SPECIAL TOOLING	$1212	1129	7	0115	1	DOLLARS															402
	06	DATA	$1220	1130	7	1317	1	% SPREAD	$1210														404
	06	FIRST DESTINATION TRANS	$1230	1131	7	1318	1	% SPREAD	$1210														405
	06	INSTALLATION & CHECKOUT	$1240	1132	4	2204	1	MAN YRS-AF OFFICERS															406
	06						2	MAN YRS-AF AIRMEN															407
	06						3	MAN YRS-CONT. ENG.															408
	06						4	MAN YRS-CONT. TECH.															409
	06						5	% SPREAD-MAT. & SPARES	$1210														410
	06	INITIAL SPARES	$1300	1133	7	0218	1	*TOTAL															425
	06	SPARES	$1310	1134	7	1319	1	% SPREAD	$1210														423
	06	TRANSPORTATION OF SPARES	$1320	1135	7	1320	1	% SPREAD	$1310														424
	06	AEROSPACE GROUND EQUIP (AGE)	$2000	1136	0	0317	1	*TOTAL															435
	06	DEVELOPMENT, TEST, & EVAL	$2100	1137	6	1126	1	*$ DIRECT	$1100														427
	06	PROCUREMENT & INSTALLATION	$2200	1138	0	1145	1	*$ DIRECT	$1200														432
	06			1138	0	0413	OR 1	*TOTAL															433
	06	EQUIPMENT	$2210	1139	7	1127	1	*$ DIRECT	$1210														428
	06	DATA	$2220	1140	7	1128	1	*$ DIRECT	$1220														429
	06	FIRST DESTINATION TRANS	$2230	1141	7	1129	1	*$ DIRECT	$1230														430
	06	INSTALLATION & CHECKOUT	$2240	1142	4	1130	1	*$ DIRECT	$1240														431
	06	INITIAL SPARES	$2300	1143	7	1131	1	*$ DIRECT	$1210														434
	06	REPLACEMENT, MAINT & RENTALS	$3000	1144	4	0219	1	*TOTAL															440
	06	MATERIALS & SERVICES	$3100	1145	4	0414	1	*TOTAL															440
	06	FOLLOW-ON SPARES	$3110	1146	4	1507	1	% OPERATIONS	$1210														436
	06	TRAN OF FOLLOW-ON SPARES	$3120	1147	4	1132	1	*$ DIRECT	$3110														437
	06	EQUIPMENT REPLACEMENT	$3130	1148	4	1508	1	% OPERATIONS	$1210														438
	06	SUBCONTRACT MAINTENANCE	$3140	1149	4	0116	1	DOLLARS															439
	06	RENTALS	$3200	1150	4	0117	1	DOLLARS															443
	06																						

MCP 10000

69

* – Indicates that no "Years" data is required.
X – Check this column if line is to be key punched.
T – Card Code for type of card.
Y – Scale Factor for Years Data – Dollar Estimates – exponent of 0-6, for example 6 represents $ x 10^6
Indirect Estimates – number of decimal places in the data, for example 2 represents x x 10^{-2}
Z – 0-6 if prior years total is given in dollars, the digit representing the exponent.
7 if prior years total is given in other unit of measure

INPUT COST ELEMENT ESTIMATES

ANALYST _____ DATE _____ SYSTEM NO. _____ PASS NO. _____ RUN NO. _____

FIELD # 1	FIELD # 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
												YEARS										
E	T	ELEMENT NAME & NUMBER	SEQ. NO.	SUB CODE	USUAL CER #	CARD #	UNIT OF MEASURE	REFER. ELEM. #	Y	Z	PRIOR TOTAL	N	N-1	N-2	N-3	N-4	N-5	N-6	N-7	N-8	N-9	SORT CODE
	06	AEROSPACE VEHICLES SUBSYSTEM	1151	0	0318	1	*TOTAL															505
	06	SURFACE EQUIPMENT	1152	0	0319	1	*TOTAL															506
	06	DEVELOPMENT, TEST, & EVAL	1153	6	1321	1	% SPREAD															521
	06		1153	6	0320	OR 1	*TOTAL															522
	06	ANALYSIS & DESIGN	1154	6	1711	1	MAN YRS--CONT. ENG.															512
	06					2	MAN YRS--CONT. TECH.															513
	06	FABRICATION FOR TEST	1155	6	0220	1	*TOTAL															518
	06	RECORDS, PHOTO, & OTHER	1156	6	2705	1	MAN YRS--CONT. ENG.															514
	06					2	MAN YRS--CONT. TECH.															515
	06					3	DOLLARS--MATERIALS															516
	06	DEV TOOL & TEST EQUIP	1157	6	1133	1	*% DIRECT	61121														517
	06	TEST & EVALUATION	1158	6	1712	1	MAN YRS--CONT. ENG.															519
	06					2	MAN YRS--CONT. TECH.															520
	06	PROCUREMENT & INSTALLATION	1159	0	0415	1	*TOTAL															511
	06	PRIME EQUIPMENT	1160	7	0221	1	*TOTAL															503
	06	MISSION HARDWARE	1161	7	0118	1	DOLLARS															501
	06	SPECIAL TOOLING	1162	7	0119	1	DOLLARS															502
	06	DATA	1163	7	1322	1	% SPREAD	61210														504
	06	FIRST DESTINATION TRANS	1164	7	1323	1	% SPREAD	61210														505
	06	INSTALLATION & CHECKOUT	1165	4	2205	1	MAN YRS--AF OFFICERS															506
	06					2	MAN YRS--AF AIRMEN															507
	06					3	MAN YRS--CONT. ENG.															508
	06					4	MAN YRS--CONT. TECH.															509
	06					5	% SPREAD--MAT. & SPARES	61210														510
	06		1165	4	0127	OR 1	DOLLARS															504
	06	INITIAL SPARES	1166	7	0223	1	*TOTAL															525
	06	SPARES	1167	7	1324	1	% SPREAD	61210														523
	06	TRANSPORTATION OF SPARES	1168	7	1325	1	% SPREAD	61210														524
	06	AEROSPACE GROUND EQUIP (AGE)	1169	6	0321	1	*TOTAL															535
	06	DEVELOPMENT, TEST, & EVAL	1170	6	1134	1	*% DIRECT	61100														527
	06	PROCUREMENT & INSTALLATION	1171	0	1146	1	*% DIRECT	61200														532
	06		1171	0	0416	OR 1	*TOTAL															533
	06	EQUIPMENT	1172	7	1135	1	*% DIRECT	61210														528
	06	DATA	1173	7	1136	1	*% DIRECT	61220														529
	06	FIRST DESTINATION TRANS	1174	7	1137	1	*% DIRECT	61230														530
	06	INSTALLATION & CHECKOUT	1175	4	1138	1	*% DIRECT	61240														531
	06	INITIAL SPARES	1176	7	1139	1	*% DIRECT	61210														534
	06	REPLACEMENT, MAINT & RENTALS	1177	4	0223	1	*TOTAL															544
	06	MATERIALS & SERVICES	1178	4	0417	1	*TOTAL															540
	06	FOLLOW-ON SPARES	1179	4	1509	1	% OPERATIONS	61210														536
	06	TRAN OF FOLLOW-ON SPARES	1180	4	1140	1	*% DIRECT	60110														537
	06	REPLACEMENT	1181	4	1510	1	% OPERATIONS	61210														538
	06	SUBCONTRACT MAINTENANCE	1182	4	0128	1	DOLLARS															539
	06	RENTALS	1183	4	0121	1	DOLLARS															543

NEXT CARD

* – Indicates that an "Years" data is required.
Z – Check this column if line is to be key punched.
T – Card Code for type of card.
Y – Scale Factor for Years Data – Dollar Estimates – exponent of 0-6; for example 6 represents 8×10^6
Indirect Estimates – number of decimal places in the data; for example 2 represents $\# \times 10^{-2}$
Z – 0-6 if prior years total is given in dollars, the digit representing the exponent.
7 if prior year's total is given in other unit of measure.

ANALYST _____ DATE 6/12/63

INPUT COST ELEMENT ESTIMATES

SYSTEM NO. SAMPLE PASS NO. 1 RUN NO. 1

FIELD 1		3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
X	Y	ELEMENT NAME & NUMBER		SEQ. NO.	BUD. CODE	USUAL CER #	CARD #	UNIT OF MEASURE	CODED LABEL #	Y	Z	PRIOR TOTAL	YEARS N	N+1	N+2	N+3	N+4	N+5	N+6	N+7	N+8	N+9	SORT CODE
✓	06	COMPUTER PROGRAMS	70000	1184	0	0322	1	*TOTAL															632
✓	06	MISSION PROGRAMS	71000	1185	0	0224	1	*TOTAL															619
✓	06	DEVELOPMENT	71100	1186	6	0323	1	*TOTAL															618
✓	06	PLANNING	71110	1187	6	1324	1	% SPREAD	71210	C				X									611
✓	06	EXPERI & PROTOTYPE PROGS	71120	1188	6	1601	1	NO. OF INSTRUCTIONS		C				XXXX	XXXX								612
	06			1188	6	1713	OR 1	MAN YRS-PROGRAMMERS															613
	06						2	COMPUTER HOURS															614
	06	SIM & DATA REDUC PROGS	71130	1189	6	1602	1	NO. OF INSTRUCTIONS															615
✓	06			1189	6	1714	OR 1	MAN YRS-PROGRAMMERS		C				XXX	X								616
✓	06						2	COMPUTER HOURS		C				XXX	XXX								617
✓	06	PRODUCTION	71200	1190	7	0225	1	*TOTAL															610
	06	OPERATIONAL PROGRAMS	71210	1191	7	1603	1	NO. OF INSTRUCTIONS															605
	06			1191	7	1715	OR 1	MAN YRS-PROGRAMMERS															606
	06						2	COMPUTER HOURS															607
✓	06			1191	7	0324	OR 1	*TOTAL															608
✓	06	CODING SPECIFICATIONS	71211	1192	7	1604	1	MAN YRS-PROGRAMMERS		1				XXX									601
✓	06	CODING	71212	1193	7	1605	1	MAN YRS-PROGRAMMERS		1				XXX	XXX								602
✓	06	PARAM & ASSEMBLY TESTS	71213	1194	7	1716	1	MAN YRS-PROGRAMMERS		1					XXX	XXX							603
✓	06						2	COMPUTER HOURS		1					XXXX	XXXX							604
✓	06	DATA	71220	1195	7	1327	1	% SPREAD	71210	2					XXX	XXX							609
✓	06	UTILITY & MAINTENANCE PROGS	72000	1196	0	0226	1	*TOTAL															626
✓	06	DEVELOPMENT	72100	1197	6	1328	1	% SPREAD	72200	2					XXX								628
✓	06	PRODUCTION	72200	1198	7	0227	1	*TOTAL															625
✓	06	PROGRAMS	72210	1199	7	1606	1	NO. OF INSTRUCTIONS		0					XXXX	XXXX							621
	06			1199	7	1717	OR 1	MAN YRS-PROGRAMMERS															622
	06						2	COMPUTER HOURS															623
✓	06	DATA	72220	1200	7	1329	1	% SPREAD	72210	2					XXX	XXX							624
✓	06	PROG MAINT & OPER EXERCISES	72300	1201	4	0228	1	*TOTAL															631
✓	06	MAINTENANCE OF PROGRAMS	72310	1202	4	1718	1	MAN YRS-PROGRAMMERS		1					XXX	XXX	XXX	XXX	XXX	XXX	XXX		627
✓	06						2	COMPUTER HOURS		C					XXX	XXX	XXX	XXX	XXX	XXX	XXX		628
✓	06	OPERATIONAL EXERCISES	72320	1203	4	1719	1	MAN YRS-PROGRAMMERS		C								XXX		XXX			629
✓	06						2	COMPUTER HOURS		C								XXX		XXX			630
	06																						
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MCP 1000g

* – Indicates that no "Years" data is required.
X – Check this column if line is to be key punched.
Y – Card Code for type of card.
Y – Scale Factor for Years Data – Dollar Estimates – exponent of 0-6, for example 6 represents $ x 10^6
Indirect Estimates – number of decimal places in the data, for example 2 represents # x 10^{-2}
Z – 0-6 if prior years total is given in dollars, the digit representing the exponent.
7 if prior years total is given in other unit of measure.

ANALYST _____ DATE 6/17/63

INPUT COST ELEMENT ESTIMATES

SYSTEM NO. SAMPLE PASS NO. 1 RUN NO. 1

Card 1	2		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
												YEARS										
	T	ELEMENT NAME & NUMBER	SEQ. NO.	SUB CODE	USUAL CER #	CARD T	UNIT OF MEASURE	SUPPL. ELEM. #	T	Z	PRIOR TOTAL	N	N+1	N+2	N+3	N+4	N+5	N+6	N+7	N+8	N+9	SORT CODE
	06	PERSONNEL 00000	1204	0	0325	1	*TOTAL															707
	06	OPERATIONAL PERS DEV & TRAIN 01000	1205	0	0329	1	*TOTAL															710
	06	RESEARCH & DEVELOPMENT 01100	1206	6	1720	1	MAN YRS-CONT. ENG.		C													701
	06					2	MAN YRS-CONT. TECH.		C													702
	06	INITIAL TRAINING & TRAVEL 01300	1207	0	0326	1	*TOTAL															709
	06	INITIAL TRAINING 01310	1208	7	3001	1	NUMBER OF MEN		C													703
	06					2	TR AID COST		3													704
	06					3	LENGTH		C													705
	06	POSITIONAL HANDBOOKS 01320	1209	7	1901	1	SPREAD	01320	5													706
	06					2	NO. OPERATOR POS.		C													707
	06	TRAVEL & TRANSPORTATION 01330	1210	5	1607	1	NUMBER OF MEN		C													708
	06	MAINT & SUP PERS DEV & TRAIN 02000	1211	0	0230	1	*TOTAL															727
	06	EQUIPMENT MAINT PERSONNEL 02100	1212	0	0231	1	*TOTAL															710
	06	RESEARCH & DEVELOPMENT 02110	1213	6	1721	1	MAN YRS-CONT. ENG.		C													711
	06					2	MAN YRS-CONT. TECH.		C													712
	06	INIT TRAINING & TRAVEL 02120	1214	0	0232	1	*TOTAL															717
	06	INITIAL TRAINING 02121	1215	7	3002	1	NUMBER OF MEN		C													713
	06					2	TR AID COST		3													714
	06					3	LENGTH		C													715
	06	TRAVEL & TRANS 02122	1216	5	1608	1	NUMBER OF MEN		C													716
	06	SUPPORT PERSONNEL 02200	1217	0	0233	1	*TOTAL															726
	06	RESEARCH & DEVELOPMENT 02210	1218	6	1722	1	MAN YRS-CONT. ENG.		7													719
	06					2	MAN YRS-CONT. TECH.															720
	06	INIT TRAINING & TRAVEL 02220	1219	0	0234	1	*TOTAL															725
	06	INITIAL TRAINING 02221	1220	7	3003	1	NUMBER OF MEN		C													721
	06					2	TR AID COST		C													722
	06					3	LENGTH		C													723
	06	TRAVEL & TRANS 02222	1221	5	1609	1	NUMBER OF MEN		C													724
	06	PERSONNEL OPERATIONS 03000	1222	0	0327	1	*TOTAL															746
	06	OPERATIONAL PERSONNEL 03100	1223	0	0501	1	*TOTAL															733
	06	OFFICER PAY & ALLOWANCES 03110	1224	5	1610	1	MAN YRS-AF OFFICERS		C													728
	06	AIRMAN PAY & ALLOWANCES 03120	1225	5	1611	1	MAN YRS-AF AIRMEN		C													729
	06	AIR FORCE CIVILIAN PAY 03130	1226	4	1612	1	MAN YRS-AF CIV		7													730
	06	ATTRITION TRAINING 03140	1227	4	1202	1	*$ DIRECT	(1)														731
	06	ATTRITION TRAVEL & TRANS 03150	1228	5	1203	1	*$ DIRECT	(1)														732
	06	EQUIPMENT MAINT PERSONNEL 03200	1229	0	0502	1	*TOTAL															739
	06	OFFICER PAY & ALLOWANCES 03210	1230	5	1613	1	MAN YRS-AF OFFICERS		C													734
	06	AIRMAN PAY & ALLOWANCES 03220	1231	5	1614	1	MAN YRS-AF AIRMEN		C													735
	06	AIR FORCE CIVILIAN PAY 03230	1232	4	1615	1	MAN YRS-AF CIV		7													736
	06	ATTRITION TRAINING 03240	1233	4	1204	1	*$ DIRECT	(2)														737
	06	ATTRITION TRAVEL & TRANS 03250	1234	5	1205	1	*$ DIRECT	(2)														738
	06	SUPPORT PERSONNEL 03300	1235	0	0503	1	*TOTAL															745
	06	OFFICER PAY & ALLOWANCES 03310	1236	5	1616	1	MAN YRS-AF OFFICERS		C													740
	06	AIRMAN PAY & ALLOWANCES 03320	1237	5	1617	1	MAN YRS-AF AIRMEN		C													741
	06	AIR FORCE CIVILIAN PAY 03330	1238	4	1618	1	MAN YRS-AF CIV		7													742
	06	ATTRITION TRAINING 03340	1239	4	1206	1	*$ DIRECT	(3)														743
	06	ATTRITION TRAVEL & TRANS 03350	1240	5	1207	1	*$ DIRECT	(3)														744
	06	(1) 03110 + 03120 (2) 03210 + 03220 (3) 03310 + 03320																				

WCF 1000B

* – Indicates that no "Years" data is required.
Z – Check this column if line is to be key punched.
T – Card Code for type of card.
Y – Scale Factor for Years Data – Dollar Estimates – exponent of 0-6, for example 6 represents $ x 10^6
Indirect Estimates – number of decimal places in the data, for example 2 represents # x 10^{-2}
Z – 0-6 if prior years total is given in dollars, the digit representing the exponent.
7 if prior years total is given in other unit of measure.

INPUT COST ELEMENT ESTIMATES

ANALYST ______ DATE ______ SYSTEM NO. ______ PASS # ______ RUN NO. ______

FIELD # 1	2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
													YEARS										
X	Y	ELEMENT NAME & NUMBER		SEQ. NO.	SUB. CODE	USUAL CER #	CARD #	UNIT OF MEASURE	APPROP. ELEM. #	Y	Z	PRIOR TOTAL	M	M+1	M+2	M+3	M+4	M+5	M+6	M+7	M+8	M+9	SORT CODE
✓	06	FACILITIES & SUPPORT	90000	1341	0	0418	1	*TOTAL															826
✓	06	OPERATIONAL & SUPPORT FACIL	91000	1342	3	0235	1	*TOTAL															813
✓	06	RESEARCH & DEVELOPMENT	91100	1343	3	1401	1	% SPREAD	(1)														812
✓	06	PROCUREMENT	91200	1344	3	0419	1	*TOTAL															811
✓	06	LAND ACQUISITION	91210	1345	3	0122	1	DOLLARS															801
✓	06	EXISTING FACIL CHANGES	91220	1346	3	0123	1	DOLLARS															802
✓	06	BASIC FACILITIES	91230	1347	3	2401	1	DOLLARS: PREPARATION															803
✓	06						2	DOLLARS: EXCAVATION															804
	06						3	DOLLARS: STRUCTURE															805
✓	06						4	DOLLARS: UTILITIES															806
✓	06	CONTINGENCIES	91240	1348	3	2501	1	% SPREAD: SITE EXP	(1)														807
✓	06						2	% SPREAD: CONS. SUP.	(1)														808
✓	06						3	% SPREAD: CONT. OH&P	(1)														809
✓	06						4	% SPREAD: CONTING.	(1)														810
✓	06	INITIAL STOCKS	92000	1349	3	1902	1	% SPREAD: NO. OF MEN	92000														814
✓	06						2	NO OF MEN															815
✓	06	ORGANIZATIONAL EQUIPMENT	93000	1250	3	1141	1	*% DIRECT	92000														816
✓	06	FACILITIES MAINT & OPERATION	94000	1251	4	0236	1	*TOTAL															825
✓	06	MATERIALS & SERVICES	94100	1252	4	0601	1	*TOTAL															823
✓	06	FOLLOW-ON SPARES	94110	1253	4	1511	1	% OPERATIONS	91200														817
✓	06	HARDWARE REPLACEMENT	94120	1254	4	1512	1	% OPERATIONS	91200														818
✓	06	STOCKS CONSUMPTION	94130	1255	4	1513	1	% OPERATIONS	92000														819
✓	06	ORG EQUIP REPLACEMENT	94140	1256	4	1514	1	% OPERATIONS	93000														820
✓	06	UTILITIES SERVICES	94150	1257	4	0124	1	DOLLARS															821
✓	06	SUBCONTRACT MAINTENANCE	94160	1258	4	0125	1	DOLLARS															822
✓	06	LEASED FACILITIES	94200	1259	4	0126	1	DOLLARS															824
	06	(1) 91210 + 91220 + 91230																					
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* – Indicates that no "Years" data is required.
X – Check this column if line is to be key punched.
T – Card Code for type of card.
Y – Scale Factor for years Data – Dollar Estimates – exponent of 0-6, for example 6 represents $ × 10^6
Indirect Estimates – number of decimal places in the data, for example 2 represents # × 10^{-2}
Z – 0-6 if prior years total is given in dollars, the digit representing the exponent.
7 if prior years total is given in other unit of measure.

INPUT COST ELEMENT ESTIMATES

ANALYST ______ DATE 6/17/63 ______ SYSTEM NO. SAMPLE ______ PASS NO. 1 ______ RUN NO. 1

1 X	2 T	3* ELEMENT NAME & NUMBER	4 SEQ. NO.	5 SUB. CODE	6 USUAL CER #	7 CARD #	8 UNIT OF MEASURE	9 [illegible] ELEM. #	10 V	11 Z	12 PRIOR TOTAL	13 YEARS N	14 N+1	15 N+2	16 N+3	17 N+4	18 N+5	19 N+6	20 N+7	21 N+8	22 N+9	23 SORT CODE
✓	06	AEROSPACE VEHICLES	115	C	9906	1																545
	06																					
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* – Indicates that no "Years" data is required.

X – Check this column if line is to be punched.

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V – Scale Factor for Years Data – Dollar Estimates – exponent of 0-6, for example 6 represents $ x 10^6
Indirect Estimates – number of decimal places in the data, for example 2 represents x 10^{-2}

Z – 0-6 if prior years total is given in dollars, the digit representing the exponent.
7 if prior years total is given in other unit of measure.

COST MODEL WORK SHEET - #1

SYSTEM INFORMATION

ANALYST _____

DATE _____

SYSTEM NAME OR # _____ # OF RUNS _____ # OF PASSES PER RUN _____ FIRST YEAR _____ # OF DEC. TABLE R _____ (TABLE A BY RUNS) TABLE R # _____ # OF YEARS OF ANNUAL OPS _____

FACTOR & PERCENTAGE CHANGES FOR THIS SYSTEM

FACTOR OR % NUMBER	NEW VALUE	OLD VALUE

FACTOR OR % NUMBER	NEW VALUE	OLD VALUE

FACTOR OR % NUMBER	NEW VALUE	OLD VALUE

OUTPUT FORMAT CONTROL FOR RUN AND PASS INFORMATION

RUN OR PASS	RUN OR PASS #	TABLE A			TABLE B			TABLE C			TABLE D			TABLE E			TABLE S (STRUCTURE)			TABLE P (TABLE A BY PASS)		
		PRINT? Y OR N	# OF DEC.*	TABLE #	PRINT? Y OR N	# OF DEC.*	TABLE #	PRINT? Y OR N	# OF DEC.*	TABLE #	PRINT? Y OR N	# OF DEC.*	TABLE #	PRINT? Y OR N	# OF DEC.*	TABLE #	PRINT? Y OR N	# OF DEC.*	TABLE #	PRINT? Y OR N	# OF DEC.*	TABLE #
FIRST RUN																						
PASSES FOR 1ST RUN																						
ALL SUBSEQ. RUNS																						
PASSES FOR ALL SUBSEQ. RUNS																						

NCP 1000n

* Tables give results in millions of dollars.

COST MODEL WORK SHEET #2
(For Sensitivity Analysis)

SYSTEM # ________________

ANALYST ________________

DATE ________________

RUN #	FACTOR #	NEW VALUE (N) (OR) INCREMENT (I)	N OR I	IF I, # OF TIMES INCREMENTED	ELEMENT #'s CHANGED IN RUN													

AUTHOR ______
DATE ______
PAGE ______ OF ______ PAGES

KEY PUNCH SHEET - SYSTEM, RUN AND PASS CONTROL INFORMATION

HEADER CARD

CARD CODE	MONTH	DAY	YEAR	# OF SYS.	DESCRIPTION	IDENTIFICATION RUN #	PASS #	SORT CODE
0 0						0 0 0	0 0	0 0 0

SYSTEM CARD

CARD CODE	SYSTEM NAME	# OF RUNS	# OF PASSES PER RUN	YEAR (M)	NUMBER OF ELEMENTS IN SUBSYSTEM # 1 2 3 4 5 6 7 8 9	# OF DEC TABLES	TABLE # FOR TABLE S	DESCRIPTION	
0 1									0 0 0 0 0 0 1

RUN AND PASS CONTROL CARDS

CARD CODE	SYSTEM NAME	RUN #	PASS #	TABLE A: Y OR N	# OF DEC	TABLE #	TABLE B: Y OR N	# OF DEC	TABLE #	TABLE C: Y OR N	# OF DEC	TABLE #	TABLE D: Y OR N	# OF DEC	TABLE #	TABLE E: Y OR N	# OF DEC	TABLE #	TABLE S: Y OR N	# OF DEC	TABLE #	TABLE P: Y OR N	# OF DEC	TABLE #	# OF FACT INCR	# OF FACT CHGS	# OF ELE CHGS	

KEY PUNCH SHEET FOR PARAMETER CARDS

AUTHOR ____________

DATE ____________

PAGE ______ OF ______ PAGES

CARD CODE (1–2)	CSR # (3–4)	CSR LINE (5–6)	SUBSL #* (7–8)	SEQUENCE # (9–12)	# OF PARAM. (13–14)	1ST PARAM. (15–18)	2ND PARAM. (19–22)	3RD PARAM. (23–26)	4TH PARAM. (27–30)	5TH PARAM. (31–34)	6TH PARAM. (35–38)	7TH PARAM. (39–42)	8TH PARAM. (43–46)	9TH PARAM. (47–50)	10TH PARAM. (51–54)	(55–72)	(73)	IDENTIFICATION RUN NO. (74–75)	IDENTIFICATION PASS NO. (76–77)	IDENTIFICATION SORT CODE (78–80)
0 2																		0 0	0 0	0 0 2
0 2																		0 0	0 0	0 0 2
0 2																		0 0	0 0	0 0 2
0 2																		0 0	0 0	0 0 2
0 2																		0 0	0 0	0 0 2
0 2																		0 0	0 0	0 0 2
0 2																		0 0	0 0	0 0 2
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MCP 1000   *Octal Code

AUTHOR _____

DATE _____

PAGE _____ OF _____ PAGES

KEY PUNCH SHEET FOR FACTORS & PERCENTAGES (AND CHANGES)

CARD CODE	FACTOR #	VALUE OR INCREMENT ± X . X X X E ± X X	IF INC. # OF INCS.	DESCRIPTION	IDENTIFICATION RUN #	PASS #	SORT CODE
1 2	3 4 5	6 7 8 9 10 11 12 13 14 15	16 17 18	19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72	73	74 75	76 77	78 79 80

79

MCP 1008m

CARD CODE	CARD TYPE
03	Factor or Percentage for Run 1
-1	Incremental Change in Factor or Percentage for Sensitivity Analysis
-3	Factor or Percentage Change for Sensitivity Analysis.

KEY PUNCH SHEET FOR PARAMETER CARDS

AUTHOR _____

EXHIBIT 2

STANDARD TABLE FORMATS

	Page
Summary Cost Estimates	81
Detailed Cost Estimate	82
Summary Cost Estimate by Budget Codes	83
Subsystem Cost Estimates by Budget Codes	84
Hardware Subsystems Cost Estimates by Budget Codes	85
Structure Element Cost Estimates	86-95
Summary Costs by Passes	96
Summary Costs by Runs	97

Major References in Text - Sections 2.5, 3.4, 4.3

TABLE S1A

DATE 6/18/63
SYSTEM NO. SAMPLE
RDA NO. 1

SUMMARY COST ESTIMATE BY YEARS OF RDA 1
(IN MILLIONS OF DOLLARS)
FISCAL YEAR

	PRIOR	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	TOTAL
RDT&E												
SYSTEM DESIGN & MANAGEMENT	0.4	0.4	2.3	2.5	1.8	0.5	0.	0.	0.	0.	0.	8.4
SUBSYSTEM DEVELOPMENT & TEST	0.1	2.8	3.7	1.2	0.6	0.5	0.3	0.2	0.1	0.1	0.	9.8
SYSTEM INTEG, TEST & EVAL	0.0	0.1	5.7	11.4	5.7	0.4	0.	0.	0.	0.	0.	23.4
TOTAL RDT&E	0.6	3.4	11.7	15.0	8.2	1.4	0.3	0.2	0.1	0.1	0.	41.6
INITIAL INVESTMENT												
MISSILE EQUIPMENT & AGE	0.	10.2	31.1	41.5	12.0	2.0	4.3	7.5	0.6	0.	0.	109.8
INITIAL SPARES & STOCKS	0.	0.5	6.8	9.4	3.4	1.8	0.7	1.0	0.	0.	0.	24.6
COMPUTER PROGRAM PRODUCTION	0.	0.	0.3	0.5	0.7	0.	0.	0.	0.	0.	0.	2.0
INITIAL TRAINING & TRAVEL	0.	0.	2.1	1.2	4.0	0.4	0.	0.	0.	0.	0.	7.7
FACILITIES	0.	19.4	13.4	5.2	0.	0.	0.	0.	1.0	1.0	0.	39.9
TOTAL INITIAL INVESTMENT	0.	30.0	53.7	58.0	20.1	4.2	5.0	9.1	1.6	1.0	0.	184.0
OPERATIONS												
EQUIP REPLACEMENT & PAINT	0.	0.	0.	0.4	2.9	8.0	8.7	8.7	10.3	10.8	2.1	51.8
COMPUTER PROGRAM MAINTENANCE	0.	0.	0.	0.2	0.5	1.1	1.5	1.1	1.5	1.1	0.	7.1
COMMUNICATION & EQUIP RENTAL	0.	0.	1.1	7.5	13.9	13.9	13.9	13.5	14.0	14.0	0.1	92.3
PERSONNEL	0.	0.	0.	1.2	5.1	10.1	10.1	10.1	10.1	10.1	0.	56.8
FACILITIES MAINTENANCE	0.	0.	0.	0.5	2.1	4.4	4.4	4.4	4.7	4.7	0.	25.3
TOTAL OPERATIONS	0.	0.	1.1	10.0	24.6	37.4	38.6	38.2	40.5	40.7	2.2	233.3
TOTAL SYSTEM	0.6	34.0	66.5	84.3	52.8	43.0	43.5	47.0	42.2	41.7	2.2	458.8

DATE 07/18/63
SYSTEM P.C. SAMPLE
RCA NO. 1

DETAILED COST ESTIMATE OF RCA 1
(IN MILLIONS OF DOLLARS)
FISCAL YEAR

	PRIOR	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	TOTAL
RDT&E												
SYSTEM DESIGN	0.400	0.396	1.576	1.576	1.161	0.396	0.	0.	0.	0.	0.	5.506
SYSTEM MANAGEMENT	0.042	0.050	0.730	1.297	0.687	0.081	0.	0.	0.	0.	0.	2.888
SUB-SYSTEM DEVELOPMENT	0.164	2.841	3.697	1.926	0.615	0.541	0.270	0.270	0.060	0.060	0.	9.785
HARDWARE SUBSYSTEMS	0.164	1.040	0.936	0.	0.	0.541	0.270	0.270	0.	0.	0.	3.162
ANALYSIS & DESIGN	0.	0.254	0.254	0.	0.	0.	0.	0.	0.	0.	0.	0.508
FABRICATION PGM TEST	0.	0.156	0.156	0.	0.	0.	0.	0.	0.	0.	0.	0.312
TEST & EVALUATION	0.	0.095	0.095	0.	0.	0.	0.	0.	0.	0.	0.	0.190
AGE & NON-SUBDIVIDED	0.164	0.535	0.431	0.	0.	0.541	0.270	0.270	0.	0.	0.	2.152
COMPUTER PROGRAMS	0.	0.	1.346	0.271	0.	0.	0.	0.	0.	0.	0.	1.617
MASTER PROGRAM PLANNING	0.	0.	0.379	0.	0.	0.	0.	0.	0.	0.	0.	0.379
EXPER & PROTOTYPE PROGS	0.	0.	0.180	0.060	0.	0.	0.	0.	0.	0.	0.	0.240
SIP & DATA REDUC PROGS	0.	0.	0.655	0.211	0.	0.	0.	0.	0.	0.	0.	0.866
UTIL-MAINT PROG PLANNING	0.	0.	0.132	0.	0.	0.	0.	0.	0.	0.	0.	0.132
PERSONNEL	0.	0.	1.320	1.655	0.615	0.	0.	0.	0.	0.	0.	2.990
FACILITIES	0.	1.801	0.095	0.	0.	0.	0.	0.	0.060	0.060	0.	2.016
SYSTEM INTEG, TEST & EVAL	0.019	0.103	5.727	11.397	5.711	0.415	0.	0.	0.	0.	0.	23.372
INTRA-SYSTEM INTEGRATION	0.009	0.103	5.194	5.586	0.	0.	0.	0.	0.	0.	0.	10.893
INTER-SYSTEM INTEGRATION	0.010	0.	0.533	5.811	5.711	0.415	0.	0.	0.	0.	0.	12.479
TOTAL RDT&E	0.565	3.391	11.731	15.596	8.174	1.433	0.270	0.270	0.060	0.060	0.	41.551
INITIAL INVESTMENT												
MISSION EQUIPMENT & AGE	0.	10.329	31.085	41.526	11.992	1.989	4.312	7.519	0.618	0.	0.	109.770
PRIME EQUIPMENT	0.	9.816	28.620	38.011	7.700	0.	3.500	7.100	0.	0.	0.	94.647
AGE	0.	0.294	0.455	1.126	0.150	0.	0.105	0.210	0.	0.	0.	2.744
DATA	0.	0.219	1.606	2.085	0.260	0.	0.541	0.	0.	0.	0.	4.711
FIRST DESTINATION TRANS	0.	0.	0.	0.135	0.821	0.329	0.167	0.	0.	0.	0.	1.451
INSTALLATION & CHECKOUT	0.	0.	0.	0.569	3.061	1.660	0.	0.309	0.618	0.	0.	6.217
INITIAL SPARES	0.	0.920	6.765	8.922	1.167	0.006	0.681	1.625	0.	0.	0.	20.090
INITIAL STOCKS	0.	0.	0.	0.450	2.250	1.800	0.	0.	0.	0.	0.	4.500
COMPUTER PROGRAMS	0.	0.	0.345	0.527	0.697	0.	0.	0.	0.	0.	0.	1.969
MISSION PROGRAM PRODUCTION	0.	0.	0.345	0.738	0.508	0.	0.	0.	0.	0.	0.	1.591
UTIL & MAINT PROGRAM PROD	0.	0.	0.	0.189	0.189	0.	0.	0.	0.	0.	0.	0.378
PERSONNEL	0.	0.	2.128	1.205	3.582	0.410	0.	0.	0.	0.	0.	7.725
INITIAL TRAINING	0.	0.	2.075	1.100	3.650	0.375	0.	0.	0.	0.	0.	7.200
TRAVEL	0.	0.	0.052	0.105	0.332	0.035	0.	0.	0.	0.	0.	0.525
FACILITIES	0.	19.360	13.360	5.200	0.	0.	0.	0.	1.000	1.000	0.	39.920
TOTAL INITIAL INVESTMENT	0.	30.609	53.686	58.830	20.088	4.205	4.994	9.144	1.618	1.000	0.	183.974
OPERATIONS												
MISSION EQUIPMENT & AGE	0.	0.	0.	0.432	2.979	7.959	8.722	8.722	10.255	10.788	2.066	51.822
FOLLOW-ON SPARES	0.	0.	0.	0.432	2.979	7.709	8.222	8.222	8.755	9.288	1.066	46.572
SUBCONTRACTED MAINTENANCE	0.	0.	0.	0.	0.	0.250	0.500	0.500	1.500	1.500	1.000	5.250
COMMUNICATION & EQUIP RENTAL	0.	0.	1.070	7.500	13.900	13.900	13.900	13.900	14.000	14.000	0.100	92.270
LEASED CIRCUITS	0.	0.	1.000	7.000	13.000	13.000	13.000	13.000	13.000	13.000	0.	86.000
TERMINAL EQUIPMENT	0.	0.	0.070	0.500	0.900	0.900	0.900	0.900	0.900	0.900	0.	5.970
OTHER EQUIPMENT	0.	0.	0.	0.	0.	0.	0.	0.	0.100	0.100	0.100	0.300
COMPUTER PROGRAMS	0.	0.	0.	0.270	0.540	1.080	1.510	1.080	1.510	1.080	0.	7.070
MAINTENANCE	0.	0.	0.	0.270	0.540	1.080	1.080	1.080	1.080	1.080	0.	6.210
OPERATIONAL EXERCISES	0.	0.	0.	0.	0.	0.	0.430	0.	0.430	0.	0.	0.860
PERSONNEL	0.	0.	0.	1.302	5.124	10.074	10.074	10.074	10.074	10.074	0.	56.750
PAY & ALLOWANCES	0.	0.	0.	0.530	3.000	7.196	7.196	7.196	7.196	7.196	0.	40.570
ATTRITION TRAINING	0.	0.	0.	0.279	1.058	2.159	2.159	2.159	2.159	2.159	0.	12.171
ATTRITION TRAVEL	0.	0.	0.	0.093	0.366	0.720	0.720	0.720	0.720	0.720	0.	4.057
FACILITIES MAINT & OPERATION	0.	0.	0.	0.540	2.100	4.396	4.396	4.434	4.702	4.721	0.	25.297
TOTAL OPERATIONS	0.	0.	1.070	10.044	24.551	37.410	38.602	38.210	40.542	40.663	2.166	233.257

DATE 07/19/68
SYSTEM NO. SAPPLI
REF. NO. 1

TABLE S10

SUMMARY COST ESTIMATE BY BUDGET CODES OF REF 1
(IN MILLIONS OF DOLLARS)

	PRIOR	FISCAL YEAR 1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	TOTAL
RDT&E												
P3CO MILITARY CONSTRUCTION	0.	1.8	0.1	0.	0.	0.	0.	0.	0.1	0.1	0.	2.0
P6CC RDT&E	0.6	1.6	11.6	15.6	8.2	1.4	0.3	0.3	0.	0.	0.	39.5
TOTAL RDT&E	0.6	3.4	11.7	15.6	8.2	1.4	0.3	0.3	0.1	0.1	0.	41.6
INITIAL INVESTMENT												
P3CC MILITARY CONSTRUCTION	0.	15.4	13.4	5.2	0.	0.	0.	0.	1.0	1.0	0.	39.5
P4CC OPERATION & MAINTENANCE	0.	0.	0.	0.6	3.1	1.7	0.	0.3	0.6	0.	0.	6.2
P5CC MILITARY PERSONNEL	0.	0.	0.1	0.1	0.3	0.0	0.	0.	0.	0.	0.	0.5
P6CC OTHER PROCUREMENT	0.	11.2	40.3	52.8	16.7	2.5	5.0	8.8	0.	0.	0.	137.3
TOTAL INITIAL INVESTMENT	0.	30.6	53.7	58.0	20.1	4.2	5.0	9.1	1.6	1.0	0.	184.0
OPERATIONS												
P4CC OPERATION & MAINTENANCE	0.	0.	1.1	9.0	20.5	29.5	30.7	30.3	32.6	32.7	2.2	188.6
P5CC MILITARY PERSONNEL	0.	0.	0.	1.0	4.0	7.9	7.9	7.9	7.9	7.9	0.	44.6
TOTAL OPERATIONS	0.	0.	1.1	10.0	24.6	37.4	38.6	38.2	40.5	40.7	2.2	233.3
TOTAL												
P3CC MILITARY CONSTRUCTION	0.	21.2	13.5	5.2	0.	0.	0.	0.	1.1	1.1	0.	41.9
P4CC OPERATION & MAINTENANCE	0.	0.	1.1	9.6	23.6	31.2	30.7	30.6	33.2	32.7	2.2	194.8
P5CC MILITARY PERSONNEL	0.	0.	0.1	1.1	4.4	8.0	7.9	7.9	7.9	7.9	0.	45.2
P6CC RDT&E	0.6	1.6	11.6	15.6	8.2	1.4	0.3	0.3	0.	0.	0.	39.5
P6CC OTHER PROCUREMENT	0.	11.2	40.3	52.8	16.7	2.5	5.0	8.8	0.	0.	0.	137.3
GRAND TOTAL	0.6	34.0	66.5	84.3	52.8	43.0	43.9	47.8	42.2	41.7	2.2	458.8

DATE 6/10/69
SYSTEM NO. SAMPLE
RUN NO. 1

TABLE S1L

SUBSYSTEM COST ESTIMATES BY BUDGET CODES OF RUN 1
(IN MILLIONS OF DOLLARS)

	PRIOR	FISCAL YEAR 1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	TOTAL
GENERAL SYSTEM												
P&CC R,T+E	0.5	0.5	8.0	14.3	7.6	0.9	0.	0.	0.	0.	0.	31.8
TOTAL GENERAL SYSTEM	0.5	0.5	8.0	14.3	7.6	0.9	0.	0.	0.	0.	0.	31.8
HARDWARE SUBSYSTEMS												
P4CC OPERATION + MAINTENANCE	0.	0.	1.1	8.5	19.8	23.5	22.6	22.5	24.9	24.8	2.2	150.3
P&CC R,T+E	0.1	1.0	0.9	0.	0.	0.5	0.3	0.3	0.	0.	0.	3.2
P&CC OTHER PROCUREMENT	0.	11.2	37.9	50.3	10.1	0.3	5.0	8.0	0.	0.	0.	123.6
TOTAL HARDWARE SUBSYSTEMS	0.1	12.3	39.9	58.8	29.9	24.4	27.9	32.0	24.9	24.8	2.2	277.1
COMPUTER PROGRAMS												
P4CC OPERATION + MAINTENANCE	0.	0.	0.	0.3	0.5	1.1	1.5	1.1	1.5	1.1	0.	7.1
P&CC R,T+E	0.	0.	1.3	0.3	0.	0.	0.	0.	0.	0.	0.	1.6
P&CC OTHER PROCUREMENT	0.	0.	0.3	0.5	0.7	0.	0.	0.	0.	0.	0.	2.0
TOTAL COMPUTER PROGRAMS	0.	0.	1.7	1.1	1.2	1.1	1.5	1.1	1.5	1.1	0.	10.7
PERSONNEL												
P4CC OPERATION + MAINTENANCE	0.	0.	0.	0.1	1.1	2.2	2.2	2.2	2.2	2.2	0.	12.2
P5CC MILITARY PERSONNEL	0.	0.	0.1	1.1	4.4	8.0	7.5	7.5	7.5	7.9	0.	45.2
P&CC R,T+E	0.	0.	1.3	1.1	0.6	0.	0.	0.	0.	0.	0.	3.0
P&CC OTHER PROCUREMENT	0.	0.	2.1	1.1	3.6	0.4	0.	0.	0.	0.	0.	7.2
TOTAL PERSONNEL	0.	0.	3.4	3.6	9.7	10.5	10.1	10.1	10.1	10.1	0.	67.5
FACILITIES												
P300 MILITARY CONSTRUCTION	0.	21.2	13.5	5.2	0.	0.	0.	0.	1.1	1.1	0.	41.9
P4C0 OPERATION + MAINTENANCE	0.	0.	0.	0.5	2.1	4.4	4.4	4.4	4.7	4.7	0.	25.3
P&C0 OTHER PROCUREMENT	0.	0.	0.	0.5	2.3	1.8	0.	0.	0.	0.	0.	4.5
TOTAL FACILITIES	0.	21.2	13.5	6.2	4.4	6.2	4.4	4.4	5.8	5.8	0.	71.7

DATE [illegible]
SYSTEM NO. SAMPLE
RUN NO. 1

TABLE S1E

HARDWARE SUBSYSTEMS COST ESTIMATES BY BUDGET CODES OF RUN 1
(IN MILLIONS OF DOLLARS)

	FISCAL YEAR											
	PRIOR	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	TOTAL
DATA PROCESSING												
P4CC OPERATION + MAINTENANCE	0.	0.	0.	0.6	4.9	6.6	6.0	6.3	8.2	8.2	2.2	43.1
P6CC RDT+E	0.	0.4	0.4	0.	0.	0.5	0.3	0.3	0.	0.	0.	1.9
P6CC OTHER PROCUREMENT	0.	9.4	31.5	36.0	0.7	0.1	5.0	8.6	0.	0.	0.	91.6
TOTAL DATA PROCESSING	0.	9.8	32.0	36.6	5.6	7.2	11.3	15.4	8.2	8.2	2.2	136.7
DATA PRESENTATION												
P4CC OPERATION + MAINTENANCE	0.	0.	0.	0.2	1.0	1.3	1.2	1.2	1.2	1.2	0.	7.3
P6CC RDT+E	0.	0.1	0.1	0.	0.	0.	0.	0.	0.	0.	0.	0.2
P6CC OTHER PROCUREMENT	0.	1.9	6.3	7.2	0.2	0.0	0.	0.	0.	0.	0.	15.6
TOTAL DATA PRESENTATION	0.	2.0	6.4	7.3	1.1	1.3	1.2	1.2	1.2	1.2	0.	23.0
COMMUNICATIONS												
P4CC OPERATION + MAINTENANCE	0.	0.	1.1	7.5	14.0	13.9	13.9	13.9	13.9	13.9	0.	92.1
P6CO OTHER PROCUREMENT	0.	0.	0.	0.5	2.7	0.	0.	0.	0.	0.	0.	3.2
TOTAL COMMUNICATIONS	0.	0.	1.1	8.0	16.7	13.9	13.9	13.9	13.9	13.9	0.	95.2
DATA ACQUISITION												
P4CC OPERATION + MAINTENANCE	0.	0.	0.	0.	0.	1.7	1.5	1.5	1.5	1.5	0.	7.9
P6CC RDT+E	0.1	0.5	0.4	0.	0.	0.	0.	0.	0.	0.	0.	1.0
P6CC OTHER PROCUREMENT	0.	0.	0.	6.6	6.5	0.2	0.	0.	0.	0.	0.	13.3
TOTAL DATA ACQUISITION	0.1	0.5	0.4	6.6	6.5	1.9	1.5	1.5	1.5	1.5	0.	22.2
AEROSPACE VEHICLES												
TOTALS												
P4CC OPERATION + MAINTENANCE	0.	0.	1.1	8.5	15.8	23.5	22.6	22.5	24.9	24.8	2.2	150.3
P6CC RDT+E	0.1	1.0	0.9	0.	0.	0.5	0.3	0.3	0.	0.	0.	3.2
P6CO OTHER PROCUREMENT	0.	11.2	37.9	50.3	10.1	0.3	5.0	8.6	0.	0.	0.	123.6
TOTAL BUDGET CODES	0.1	12.3	39.9	58.8	25.9	24.4	27.9	32.0	24.9	24.8	2.2	277.1

DATE 07/14/63
SYSTEM NO. SAMPLE
RUN NO. 1

TABLE S1S

STRUCTURE ELEMENT COST ESTIMATES OF RUN 1
(IN MILLIONS OF DOLLARS)
FISCAL YEAR

	PRIOR	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	TOTAL	PCT
GENERAL SYSTEM SUBSYSTEM	0.461	0.549	8.034	14.270	7.559	0.892	0.	0.	0.	0.	0.	31.766	6.9
SYSTEM DESIGN	0.400	0.396	1.576	1.576	1.161	0.396	0.	0.	0.	0.	0.	5.506	1.2
SYSTEM INTEG, TEST + EVAL	0.019	0.103	5.727	11.297	5.711	0.415	0.	0.	0.	0.	0.	23.372	5.1
INTEGRATION OF SUBSYSTEMS	0.009	0.103	5.194	5.586	0.	0.	0.	0.	0.	0.	0.	10.893	2.4
INTRA-SYSTEM ENGINEERING	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INTRA-SYS TEST PLANNING	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INTRA-SYS INTEG TESTS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INTRA-SYS DATA REDUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INTEGRATION WITH ENVIR SYS	0.010	0.	0.533	5.711	5.711	0.415	0.	0.	0.	0.	0.	12.479	2.7
INTER-SYSTEM ENGINEERING	0.010	0.	0.391	0.409	0.426	0.415	0.	0.	0.	0.	0.	1.651	0.4
INTER-SYS TEST PLANNING	0.	0.	0.142	0.142	0.	0.	0.	0.	0.	0.	0.	0.284	0.1
INTER-SYS INTEG TESTS	0.	0.	0.	5.027	5.077	0.	0.	0.	0.	0.	0.	10.104	2.2
INTER-SYS DATA REDUCTION	0.	0.	0.	0.233	0.208	0.	0.	0.	0.	0.	0.	0.441	0.1
SYSTEM MANAGEMENT	0.042	0.050	0.730	1.297	0.687	0.081	0.	0.	0.	0.	0.	2.888	0.6
ADMINISTRATIVE CONTROL	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TECHNICAL CONTROL	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

DATE 6/18/69
SYSTEM NO. SAMPLE
RUN NO. 1

TABLE S1S

STRUCTURE ELEMENT COST ESTIMATES OF RUN 1
(IN MILLIONS OF DOLLARS)
FISCAL YEAR

	PRIOR	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	TOTAL	PCT
DATA PROCESSING SUBSYSTEM	C.	5.808	31.982	36.826	5.596	7.241	11.261	15.411	8.244	8.163	2.166	136.702	29.8
MISSION EQUIPMENT	C.	5.522	31.050	35.404	3.104	1.206	5.111	5.140	0.600	C.	0.	95.139	20.7
DEVELOPMENT, TEST + EVAL	C.	C.421	C.421	C.	C.	C.525	C.262	C.262	C.	C.	0.	1.892	C.4
ANALYSIS + DESIGN	C.	C.212	C.212	C.	C.	C.	C.	C.	C.	C.	0.	C.424	C.1
FABRICATION FOR TEST	C.	C.130	C.130	C.	C.	C.	C.	C.	C.	C.	C.	C.260	C.1
MOCKUPS PROTO. + OTHER	C.	C.100	C.100	C.	C.	C.	C.	C.	0.	C.	0.	C.200	C.C
DEV TOOL + TEST EQUIP	C.	C.030	C.030	0.	C.	C.	C.	C.	0.	C.	0.	C.060	C.C
TEST + EVALUATION	C.	C.079	C.079	C.	C.	C.	C.	C.	C.	C.	0.	C.158	C.C
PROCUREMENT + INSTALLATION	C.	5.357	25.145	29.163	3.076	C.683	4.187	7.300	0.600	C.	0.	78.415	17.1
PRIME EQUIPMENT	0.	5.180	23.650	27.130	C.	C.	3.500	7.000	0.	C.	0.	69.560	15.2
MISSION HARDWARE	C.	5.180	23.650	27.130	C.	C.	3.500	7.000	0.	0.	0.	64.560	14.1
SPECIAL TOOLING	C.	5.000	C.	0.	C.	0.	C.	C.	0.	0.	C.	5.000	1.1
DATA	C.	C.177	1.295	1.476	C.	C.	C.525	C.	C.	C.	0.	3.478	C.8
FIRST DESTINATION TRANS	0.	C.	C.	0.109	0.664	C.136	C.162	C.	0.	C.	0.	1.071	C.2
INSTALLATION + CHECKOUT	C.	C.	C.	0.448	2.412	C.546	C.	0.300	0.600	C.	0.	4.306	C.9
INITIAL SPARES	C.	C.744	5.480	6.341	C.029	0.	C.661	1.577	0.	0.	0.	14.833	3.2
SPARES	C.	C.744	5.457	6.201	C.	C.	C.661	1.543	0.	C.	0.	14.608	3.2
TRANSPORTATION OF SPARES	0.	C.	0.023	0.139	C.029	C.	C.	C.034	0.	C.	0.	C.225	C.C
AEROSPACE GROUND EQUIP (AGE)	C.	C.286	C.532	1.162	C.093	0.036	C.153	C.274	0.018	C.	0.	2.854	C.6
DEVELOPMENT, TEST + EVAL	C.	C.013	C.013	0.	C.	0.016	C.008	C.008	C.	C.	0.	0.057	C.0
PROCUREMENT + INSTALLATION	C.	C.251	C.754	0.872	C.092	C.020	C.126	C.219	0.018	C.	0.	2.352	0.5
EQUIPMENT	C.	C.245	C.715	C.811	C.	C.	C.105	C.210	0.	C.	0.	2.087	C.5
DATA	C.	C.005	C.039	C.044	C.	C.	C.016	C.	0.	C.	0.	C.104	C.0
FIRST DESTINATION TRANS	C.	C.	C.	0.003	C.020	C.004	C.005	C.	0.	0.	0.	C.032	C.0
INSTALLATION + CHECKOUT	0.	C.	C.	C.013	C.072	C.016	C.	C.009	0.018	C.	0.	0.129	C.0
INITIAL SPARES	0.	C.022	C.164	C.190	C.001	C.	C.020	C.047	0.	C.	0.	C.445	C.1
REPLACEMENT, MAINT + RENTALS	C.	C.	C.	0.360	2.399	5.997	5.997	5.997	7.630	8.163	2.166	38.709	8.4
MATERIALS + SERVICES	0.	C.	C.	0.360	2.399	5.997	5.997	5.997	7.530	8.063	2.066	38.409	8.4
FOLLOW-ON SPARES	C.	C.	C.	C.354	2.362	5.906	5.906	5.906	6.431	6.956	1.050	34.872	7.6
TRAN OF FOLLOW-ON SPARES	0.	C.	C.	C.005	C.036	C.091	C.091	C.091	0.099	C.107	0.016	C.537	C.1
EQUIPMENT REPLACEMENT	C.	C.	C.	0.	C.	C.	C.	C.	0.	C.	0.	C.	C.
SUBCONTRACT MAINTENANCE	C.	C.	C.	C.	C.	C.	C.	C.	1.000	1.000	1.000	3.000	C.7
RENTALS	C.	C.	C.	C.	C.	C.	C.	C.	0.100	C.100	0.100	C.300	C.1

DATE 6/18/69
SYSTEM NO. SAMPLE
RUN NO. 1

TABLE S1S

DATE 6/19/63
SYSTEM NO. SAMPLE
RUN NO. 1

TABLE S1S

STRUCTURE ELEMENT COST ESTIMATES OF RUN 1
(IN MILLIONS OF DOLLARS)
FISCAL YEAR

	PRIOR	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	TOTAL	PCT
DATA PRESENTATION SUBSYSTEM	0.	1.982	6.392	7.341	1.142	1.346	1.199	1.199	1.199	1.199	0.	22.980	5.0
MISSION EQUIPMENT	0.	1.904	6.205	7.058	0.643	0.142	0.	0.	0.	0.	0.	15.953	3.5
DEVELOPMENT, TEST + EVAL	0.	0.084	0.084	0.	0.	0.	0.	0.	0.	0.	0.	0.168	0.0
ANALYSIS + DESIGN	0.	0.042	0.042	0.	0.	0.	0.	0.	0.	0.	0.	0.085	0.0
FABRICATION FOR TEST	0.	0.026	0.026	0.	0.	0.	0.	0.	0.	0.	0.	0.052	0.0
MOCKUPS PROTO. + OTHER	0.	0.020	0.020	0.	0.	0.	0.	0.	0.	0.	0.	0.040	0.0
DEV TOOL + TEST EQUIP	0.	0.006	0.006	0.	0.	0.	0.	0.	0.	0.	0.	0.012	0.0
TEST + EVALUATION	0.	0.016	0.016	0.	0.	0.	0.	0.	0.	0.	0.	0.032	0.0
PROCUREMENT + INSTALLATION	0.	1.671	5.030	5.613	0.615	0.137	0.	0.	0.	0.	0.	13.266	2.9
PRIME EQUIPMENT	0.	1.636	4.770	5.406	0.	0.	0.	0.	0.	0.	0.	11.812	2.6
MISSION HARDWARE	0.	0.636	4.770	5.406	0.	0.	0.	0.	0.	0.	0.	10.812	2.4
SPECIAL TOOLING	0.	1.000	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.000	0.2
DATA	0.	0.035	0.260	0.295	0.	0.	0.	0.	0.	0.	0.	0.591	0.1
FIRST DESTINATION TRANS	0.	0.	0.	0.022	0.133	0.027	0.	0.	0.	0.	0.	0.182	0.0
INSTALLATION + CHECKOUT	0.	0.	0.	0.090	0.482	0.109	0.	0.	0.	0.	0.	0.681	0.1
INITIAL SPARES	0.	0.149	1.091	1.245	0.028	0.006	0.	0.	0.	0.	0.	2.519	0.5
SPARES	0.	0.149	1.091	1.240	0.	0.	0.	0.	0.	0.	0.	2.481	0.5
TRANSPORTATION OF SPARES	0.	0.	0.	0.005	0.028	0.006	0.	0.	0.	0.	0.	0.038	0.0
AEROSPACE GROUND EQUIP (AGE)	0.	0.057	0.186	0.212	0.019	0.004	0.	0.	0.	0.	0.	0.479	0.1
DEVELOPMENT, TEST + EVAL	0.	0.003	0.003	0.	0.	0.	0.	0.	0.	0.	0.	0.005	0.0
PROCUREMENT + INSTALLATION	0.	0.050	0.151	0.174	0.018	0.004	0.	0.	0.	0.	0.	0.398	0.1
EQUIPMENT	0.	0.049	0.143	0.162	0.	0.	0.	0.	0.	0.	0.	0.354	0.1
DATA	0.	0.001	0.008	0.009	0.	0.	0.	0.	0.	0.	0.	0.018	0.0
FIRST DESTINATION TRANS	0.	0.	0.	0.001	0.004	0.001	0.	0.	0.	0.	0.	0.005	0.0
INSTALLATION + CHECKOUT	0.	0.	0.	0.003	0.014	0.003	0.	0.	0.	0.	0.	0.020	0.0
INITIAL SPARES	0.	0.004	0.033	0.037	0.001	0.000	0.	0.	0.	0.	0.	0.076	0.0
REPLACEMENT, PAINT + RENTALS	0.	0.	0.	0.672	0.480	1.199	1.199	1.199	1.199	1.199	0.	6.549	1.4
MATERIALS + SERVICES	0.	0.	0.	0.672	0.480	1.199	1.199	1.199	1.199	1.199	0.	6.549	1.4
FOLLOW-ON SPARES	0.	0.	0.	0.671	0.472	1.181	1.181	1.181	1.181	1.181	0.	6.449	1.4
TRAN OF FOLLOW-ON SPARES	0.	0.	0.	0.001	0.007	0.018	0.018	0.018	0.018	0.018	0.	0.099	0.0
EQUIPMENT REPLACEMENT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SUBCONTRACT MAINTENANCE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
RENTALS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

DATE 6/16/71
SYSTEM NO. SAMPLE
RUN NO. 1

TABLE S1S

STRUCTURE ELEMENT COST ESTIMATES OF RUN 1
(IN MILLIONS OF DOLLARS)
FISCAL YEAR

	PRIOR	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	TOTAL	PCT
COMMUNICATIONS SUBSYSTEM	0.	C.	1.07C	7.59C	16.68C	13.90C	13.90C	13.5CC	13.90C	13.9CC	0.	95.24C	2C.8
MISSION EQUIPMENT	C.	C.	C.	0.49C	2.78C	C.	C.	C.	0.	C.	0.	3.27C	C.7
DEVELOPMENT, TEST + EVAL	C.	C.	C.	C.	C.	C.	C.	C.	C.	C.	0.	0.	C.
ANALYSIS + DESIGN	C.	C.	C.	C.	C.	C.	C.	C.	0.	C.	0.	C.	C.
FABRICATION FOR TEST	C.	C.	0.	0.	C.	C.	C.	C.	0.	C.	0.	C.	C.
MOCKUPS ETC, + OTHER	C.	C.	C.	0.	C.	C.	C.	C.	0.	C.	0.	0.	C.
DEV TOOL + TEST EQUIP	C.	C.	C.	0.	C.	C.	C.	C.	0.	0.	0.	0.	C.
TEST + EVALUATION	C.	C.	0.	C.	C.	C.	C.	C.	0.	C.	0.	C.	C.
PROCUREMENT + INSTALLATION	C.	C.	C.	0.490	2.780	C.	C.	C.	0.	C.	0.	3.27C	C.7
PRIME EQUIPMENT	C.	C.	C.	0.475	2.7CC	C.	C.	C.	0.	C.	0.	3.175	C.7
MISSION HARDWARE	C.	C.	C.	0.475	2.7CC	C.	C.	C.	0.	C.	0.	3.175	C.7
SPECIAL TOOLING	C.	C.	C.	C.	C.	C.	C.	C.	0.	C.	0.	C.	C.
DATA	C.	C.	C.	0.	C.	C.	C.	C.	0.	C.	0.	0.	C.
FIRST DESTINATION TRANS	C.	C.	C.	0.	C.	C.	C.	C.	0.	0.	0.	0.	C.
INSTALLATION + CHECKOUT	C.	C.	C.	0.C15	C.C8C	C.	C.	C.	0.	C.	0.	0.C95	C.C
INITIAL SPARES	C.	C.	0.	0.	0.	C.	0.	C.	0.	C.	0.	C.	C.
SPARES	C.	C.	0.	0.	C.	C.	C.	C.	0.	C.	0.	0.	C.
TRANSPORTATION OF SPARES	C.	0.	0.	0.	C.	C.	C.	0.	0.	0.	0.	0.	C.
AEROSPACE GROUND EQUIP (AGE)	C.	C.	0.	0.	C.	C.	C.	C.	0.	C.	0.	C.	C.
DEVELOPMENT, TEST + EVAL	C.	C.	0.	0.	C.	C.	C.	C.	0.	0.	0.	C.	C.
PROCUREMENT + INSTALLATION	C.	C.	C.	C.	C.	C.	C.	C.	0.	C.	0.	0.	C.
EQUIPMENT	C.	C.	0.	0.	C.	0.	C.	C.	0.	0.	0.	0.	C.
DATA	C.	C.	C.	C.	C.	C.	C.	C.	C.	C.	0.	0.	C.
FIRST DESTINATION TRANS	C.	C.	0.	C.	C.	C.	C.	C.	0.	C.	0.	C.	C.
INSTALLATION + CHECKOUT	C.	C.	C.	0.	0.	C.	C.	C.	0.	C.	0.	0.	C.
INITIAL SPARES	C.	0.	C.	0.	C.	C.	C.	0.	0.	0.	0.	0.	C.
REPLACEMENT, PAINT + RENTALS	C.	C.	1.07C	7.5CC	13.90C	13.9CC	13.900	13.5CC	13.900	13.900	0.	91.97C	2C.0
MATERIALS + SERVICES	C.	C.	0.	0.	0.	C.	C.	C.	0.	0.	0.	C.	C.
FOLLOW-ON SPARES	C.	C.	C.	0.	C.	C.	C.	C.	0.	C.	0.	0.	C.
TRAN OF FOLLOW-ON SPARES	C.	0.	0.	0.	C.	C.	C.	C.	C.	0.	0.	0.	C.
EQUIPMENT REPLACEMENT	C.	C.	C.	0.	C.	C.	C.	C.	C.	0.	0.	C.	0.
SUBCONTRACT MAINTENANCE	C.	C.	0.	0.	C.	C.	C.	C.	0.	C.	0.	0.	C.
RENTALS	C.	C.	1.07C	7.5CC	13.9CC	13.9CC	13.5CC	13.5CC	13.90C	13.900	0.	91.97C	2C.0
LEASED CIRCUITS	C.	0.	1.COC	7.COC	13.CCC	13.0CC	13.CCC	13.CCC	13.COC	13.000	0.	86.00C	18.7
TERMINAL EQUIPMENT	C.	C.	C.C7C	C.5CC	C.9C0	C.9CC	C.900	C.5CC	0.90C	0.90C	0.	5.97C	1.3

STRUCTURE ELEMENT COST ESTIMATES OF RUN 1
(IN MILLIONS OF DOLLARS)
FISCAL YEAR

	PRIOR	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	TOTAL	PCT
DATA ACQUISITION SUBSYSTEM	C.104	C.520	C.416	6.622	6.519	1.908	1.526	1.526	1.526	1.526	0.	22.192	4.8
MISSION EQUIPMENT	C.101	C.505	C.404	6.429	6.329	1.112	C.	C.	C.	0.	0.	14.881	3.2
DEVELOPMENT, TEST + EVAL	C.101	C.505	C.404	C.	C.	C.	C.	C.	0.	0.	0.	1.010	C.2
ANALYSIS + DESIGN	0.	C.	0.	C.	C.	C.	C.	C.	0.	C.	0.	C.	C.
FABRICATION FOR TEST	C.	C.	C.	0.	C.	C.	C.	0.	0.	C.	0.	C.	C.
MOCKUPS PROTO. + OTHER	C.	C.	0.	0.	C.	0.	C.	C.	C.	0.	0.	0.	C.
DEV TOOL + TEST EQUIP	0.	C.	0.	C.	C.	C.	C.	C.	0.	C.	0.	0.	0.
TEST + EVALUATION	0.	C.	0.	0.	C.	C.	C.	C.	0.	C.	0.	C.	C.
PROCUREMENT + INSTALLATION	C.	C.	C.	5.352	5.252	1.112	C.	C.	0.	C.	0.	11.717	2.6
PRIME EQUIPMENT	0.	C.	C.	5.100	5.000	0.	C.	C.	C.	0.	0.	10.100	2.2
MISSION HARDWARE	0.	C.	C.	5.000	5.000	C.	C.	C.	0.	0.	0.	10.000	2.2
SPECIAL TOOLING	0.	C.	0.	0.100	0.	C.	C.	C.	0.	C.	0.	C.100	C.C
DATA	C.	C.	C.	0.252	C.252	0.	C.	0.	0.	0.	0.	C.505	C.1
FIRST DESTINATION TRANS	0.	C.	C.	0.	C.	0.156	C.	0.	0.	0.	0.	0.156	C.0
INSTALLATION + CHECKOUT	0.	C.	C.	0.	C.	C.957	0.	C.	0.	0.	0.	0.957	C.2
INITIAL SPARES	0.	C.	0.	1.077	1.077	C.	C.	C.	0.	0.	0.	2.154	C.5
SPARES	C.	0.	0.	1.060	1.060	0.	C.	0.	0.	0.	0.	2.121	0.5
TRANSPORTATION OF SPARES	0.	0.	0.	0.016	C.016	0.	C.	0.	0.	0.	0.	0.033	C.0
AEROSPACE GROUND EQUIP (AGE)	C.003	C.015	0.012	0.193	C.190	C.033	C.	C.	0.	C.	0.	0.446	0.1
DEVELOPMENT, TEST + EVAL	0.003	C.015	0.012	0.	C.	0.	C.	C.	0.	C.	0.	0.030	C.0
PROCUREMENT + INSTALLATION	C.	0.	C.	0.161	C.158	0.033	C.	C.	0.	C.	0.	0.352	0.1
EQUIPMENT	C.	C.	0.	0.153	C.150	0.	C.	0.	0.	0.	0.	0.303	C.1
DATA	0.	C.	0.	C.008	C.008	C.	C.	C.	0.	C.	0.	0.015	C.0
FIRST DESTINATION TRANS	0.	C.	0.	0.	C.	C.005	C.	C.	0.	C.	0.	C.005	C.0
INSTALLATION + CHECKOUT	C.	0.	0.	0.	C.	0.029	C.	0.	0.	C.	0.	0.029	0.0
INITIAL SPARES	0.	C.	0.	0.032	C.032	C.	C.	C.	0.	0.	0.	0.065	0.0
REPLACEMENT, PAINT + RENTALS	0.	C.	0.	0.	0.	C.763	1.526	1.526	1.526	1.526	0.	6.865	1.5
MATERIALS + SERVICES	0.	C.	0.	0.	C.	C.763	1.526	1.526	1.526	1.526	0.	6.865	1.5
FOLLOW-ON SPARES	0.	C.	C.	0.	C.	0.505	1.010	1.010	1.010	1.010	0.	4.545	1.0
TRAN OF FOLLOW-ON SPARES	0.	C.	0.	0.	C.	C.008	C.016	0.016	0.016	0.016	0.	0.070	C.0
EQUIPMENT REPLACEMENT	C.	C.	C.	0.	C.	C.	0.	C.	0.	0.	0.	0.	C.
SUBCONTRACT MAINTENANCE	0.	C.	C.	C.	C.	C.250	0.500	C.500	0.500	C.500	0.	2.250	C.5
RENTALS	C.	C.	C.	0.	C.	C.	C.	C.	C.	0.	0.	0.	C.

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SYSTEM NO. SAMPLE
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TABLE S1S

STRUCTURE ELEMENT COST ESTIMATES OF RUN 1
(IN MILLIONS OF DOLLARS)
FISCAL YEAR

	PRIOR	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	TOTAL	PCT
AEROSPACE VEHICLES SUBSYSTEM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MISSION EQUIPMENT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEVELOPMENT, TEST + EVAL	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ANALYSIS + DESIGN	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
FABRICATION FOR TEST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MOCKUPS PROTO, + OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEV TOOL + TEST EQUIP	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TEST + EVALUATION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PROCUREMENT + INSTALLATION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PRIME EQUIPMENT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MISSION HARDWARE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SPECIAL TOOLING	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DATA	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
FIRST DESTINATION TRANS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INSTALLATION + CHECKOUT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INITIAL SPARES	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SPARES	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRANSPORTATION OF SPARES	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
AEROSPACE GROUND EQUIP (AGE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEVELOPMENT, TEST + EVAL	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PROCUREMENT + INSTALLATION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
EQUIPMENT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DATA	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
FIRST DESTINATION TRANS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INSTALLATION + CHECKOUT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INITIAL SPARES	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
REPLACEMENT, MAINT + RENTALS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MATERIALS + SERVICES	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
FOLLOW-ON SPARES	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRAN OF FOLLOW-ON SPARES	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
EQUIPMENT REPLACEMENT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SUBCONTRACT MAINTENANCE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
RENTALS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

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TABLE S1S

STRUCTURE ELEMENT COST ESTIMATES OF RUN 1

DATE 6/18/68
SYSTEM NO. SAMPLE
RUN NO. 1

TABLE S15

STRUCTURE ELEMENT COST ESTIMATES OF RUN 1
(IN MILLIONS OF DOLLARS)
FISCAL YEAR

	PRIOR	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	TOTAL	PCT
COMPUTER PROGRAMS SUBSYSTEM	0.	0.	1.691	1.468	1.237	1.080	1.510	1.080	1.510	1.080	0.	10.656	2.3
MISSION PROGRAMS	0.	0.	1.559	1.009	0.508	0.	0.	0.	0.	0.	0.	3.076	0.7
DEVELOPMENT	0.	0.	1.214	0.271	0.	0.	0.	0.	0.	0.	0.	1.485	0.3
PLANNING	0.	0.	0.379	0.	0.	0.	0.	0.	0.	0.	0.	0.379	0.1
EXPER + PROTOTYPE PROGS	0.	0.	0.180	0.060	0.	0.	0.	0.	0.	0.	0.	0.240	0.1
SIP + DATA RECLC PROGS	0.	0.	0.655	0.211	0.	0.	0.	0.	0.	0.	0.	0.866	0.2
PRODUCTION	0.	0.	0.345	0.738	0.508	0.	0.	0.	0.	0.	0.	1.591	0.3
OPERATIONAL PROGRAMS	0.	0.	0.345	0.700	0.470	0.	0.	0.	0.	0.	0.	1.515	0.3
CODING SPECIFICATIONS	0.	0.	0.115	0.	0.	0.	0.	0.	0.	0.	0.	0.115	0.0
CODING	0.	0.	0.230	0.230	0.	0.	0.	0.	0.	0.	0.	0.460	0.1
PARAM + ASSEMBLY TESTS	0.	0.	0.	0.470	0.470	0.	0.	0.	0.	0.	0.	0.940	0.2
DATA	0.	0.	0.	0.038	0.038	0.	0.	0.	0.	0.	0.	0.076	0.0
UTILITY + MAINTENANCE PROGS	0.	0.	0.132	0.189	0.189	0.	0.	0.	0.	0.	0.	0.510	0.1
DEVELOPMENT	0.	0.	0.132	0.	0.	0.	0.	0.	0.	0.	0.	0.132	0.0
PRODUCTION	0.	0.	0.	0.189	0.189	0.	0.	0.	0.	0.	0.	0.378	0.1
PROGRAMS	0.	0.	0.	0.180	0.180	0.	0.	0.	0.	0.	0.	0.360	0.1
DATA	0.	0.	0.	0.009	0.009	0.	0.	0.	0.	0.	0.	0.018	0.0
PROG MAINT + OPER EXERCISES	0.	0.	0.	0.270	0.540	1.080	1.510	1.080	1.510	1.080	0.	7.070	1.5
MAINTENANCE OF PROGRAMS	0.	0.	0.	0.270	0.540	1.080	1.080	1.080	1.080	1.080	0.	6.210	1.4
OPERATIONAL EXERCISES	0.	0.	0.	0.	0.	0.	0.430	0.	0.430	0.	0.	0.860	0.2

DATE 6/18/67
SYSTEM NO. SAMPLE
RUN NO. 1

TABLE SIS

STRUCTURE ELEMENT COST ESTIMATES OF RUN 1
(IN MILLIONS OF DOLLARS)
FISCAL YEAR

	PRIOR	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	TOTAL	PCT
PERSONNEL SUBSYSTEM	0.	C.	3.448	3.562	9.721	10.484	10.074	10.074	10.074	10.074	0.	67.513	14.7
OPERATIONAL PERS DEV + TRAIN	0.	C.	2.358	1.410	0.432	C.	C.	C.	0.	C.	0.	4.200	C.9
RESEARCH + DEVELOPMENT	C.	C.	1.230	C.215	C.265	C.	C.	C.	0.	C.	0.	2.110	C.5
INITIAL TRAINING + TRAVEL	C.	C.	1.128	C.795	C.167	C.	C.	C.	0.	C.	0.	2.090	C.5
INITIAL TRAINING	C.	C.	C.950	0.600	C.150	C.	C.	C.	0.	C.	0.	1.700	C.4
POSITIONAL HANDBOOKS	C.	C.	0.125	0.125	C.	C.	C.	C.	0.	C.	0.	0.250	C.1
TRAVEL + TRANSPORTATION	C.	C.	C.052	0.070	C.017	C.	C.	C.	0.	C.	0.	0.140	C.0
MAINT + SUP PERS DEV + TRAIN	C.	C.	1.090	0.650	4.165	C.410	C.	C.	0.	C.	0.	6.515	1.4
EQUIPMENT MAINT PERSONNEL	C.	C.	1.090	0.650	3.630	C.410	C.	C.	0.	C.	0.	5.980	1.3
RESEARCH + DEVELOPMENT	C.	C.	C.090	0.440	C.350	C.	C.	C.	0.	0.	0.	0.880	C.2
INIT TRAINING + TRAVEL	C.	C.	1.000	0.410	3.280	C.410	C.	C.	0.	C.	0.	5.100	1.1
INITIAL TRAINING	C.	C.	1.000	C.375	3.000	C.375	C.	C.	0.	C.	0.	4.750	1.0
TRAVEL + TRANS	C.	C.	C.	C.035	C.280	C.035	C.	C.	0.	C.	0.	0.350	C.1
SUPPORT PERSONNEL	C.	0.	C.	0.	C.535	0.	C.	C.	C.	0.	0.	0.535	C.1
RESEARCH + DEVELOPMENT	C.	C.	C.	0.	C.	C.	C.	C.	0.	0.	0.	0.	C.
INIT TRAINING + TRAVEL	C.	C.	C.	0.	0.535	C.	C.	C.	0.	C.	0.	0.535	C.1
INITIAL TRAINING	C.	C.	C.	0.	0.500	0.	C.	C.	0.	0.	0.	0.500	C.1
TRAVEL + TRANS	C.	C.	C.	0.	C.035	0.	C.	0.	0.	0.	0.	0.035	C.0
PERSONNEL OPERATIONS	C.	C.	C.	1.302	5.124	10.074	10.074	10.074	10.074	10.074	0.	56.750	12.4
OPERATIONAL PERSONNEL	C.	C.	C.	0.433	1.730	3.461	3.461	3.461	3.461	3.461	0.	19.467	4.2
OFFICER PAY + ALLOWANCES	C.	C.	C.	0.231	C.923	1.846	1.846	1.846	1.846	1.846	0.	10.384	2.3
AIRMAN PAY + ALLOWANCES	C.	C.	C.	0.078	C.313	0.626	C.626	0.626	0.626	0.626	0.	3.521	0.8
AIR FORCE CIVILIAN PAY	C.	C.	C.	C.	C.	C.	C.	C.	C.	C.	0.	0.	C.
ATTRITION TRAINING	0.	C.	0.	C.093	0.371	0.742	0.742	0.742	0.742	0.742	0.	4.171	0.9
ATTRITION TRAVEL + TRANS	C.	C.	C.	0.031	0.124	0.247	0.247	0.247	0.247	0.247	0.	1.390	0.3
EQUIPMENT MAINT PERSONNEL	C.	C.	0.	0.761	3.045	6.090	6.090	6.090	6.090	6.090	0.	34.256	7.5
OFFICER PAY + ALLOWANCES	C.	C.	C.	0.231	C.923	1.846	1.846	1.846	1.846	1.846	0.	10.384	2.3
AIRMAN PAY + ALLOWANCES	C.	C.	0.	0.313	1.252	2.504	2.504	2.504	2.504	2.504	0.	14.085	3.1
AIR FORCE CIVILIAN PAY	C.	C.	C.	C.	C.	C.	C.	C.	0.	C.	0.	0.	C.
ATTRITION PAY	C.	C.	C.	0.163	C.652	1.305	1.305	1.305	1.305	1.305	0.	7.341	1.6
ATTRITION TRAVEL + TRANS	C.	C.	C.	C.054	C.217	C.435	C.435	C.435	0.435	C.435	C.	2.447	C.5
SUPPORT PERSONNEL	C.	C.	0.	0.108	0.348	C.524	C.524	C.524	0.524	C.524	0.	3.075	C.7
OFFICER PAY + ALLOWANCES	C.	C.	C.	0.046	0.092	C.092	C.092	C.092	0.092	C.092	0.	0.600	C.1
AIRMAN PAY + ALLOWANCES	C.	C.	C.	0.031	C.156	0.282	C.282	C.282	0.282	C.282	0.	1.596	C.3
AIR FORCE CIVILIAN PAY	C.	C.	C.	C.	C.	C.	C.	C.	C.	C.	0.	C.	C.
ATTRITION TRAINING	C.	C.	C.	0.023	C.075	C.112	C.112	C.112	0.112	C.112	0.	C.659	C.1
ATTRITION TRAVEL + TRANS	C.	C.	0.	0.008	C.025	C.037	C.037	C.037	0.037	C.037	0.	0.220	C.0

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RUN NO. 1

TABLE S1S

STRUCTURE ELEMENT COST ESTIMATES OF RUN 1
(IN MILLIONS OF DOLLARS)
FISCAL YEAR

	PRIOR	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	TOTAL	PCT
FACILITIES + SUPPORT SUBSYSTEM	0.	21.161	13.455	6.150	4.358	6.156	4.396	4.434	5.762	5.781	0.	71.733	15.6
OPERATIONAL + SUPPORT FACIL	0.	21.161	13.455	5.200	0.	0.	0.	0.	1.060	1.060	0.	41.936	9.1
RESEARCH + DEVELOPMENT	0.	1.801	0.095	0.	0.	0.	0.	0.	0.060	0.060	0.	2.016	0.4
PROCUREMENT	0.	19.360	13.360	5.200	0.	0.	0.	0.	1.000	1.000	0.	39.920	8.7
LAND ACQUISITION	0.	1.000	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.000	0.2
EXISTING FACIL CHANGES	0.	0.	0.	0.	0.	0.	0.	0.	1.000	1.000	0.	2.000	0.4
BASIC FACILITIES	0.	15.200	10.200	5.200	0.	0.	0.	0.	0.	0.	0.	30.600	6.7
CONTINGENCIES	0.	3.160	3.160	0.	0.	0.	0.	0.	0.	0.	0.	6.320	1.4
INITIAL STOCKS	0.	0.	0.	0.300	1.500	1.200	0.	0.	0.	0.	0.	3.000	0.7
ORGANIZATIONAL EQUIPMENT	0.	0.	0.	0.150	0.750	0.600	0.	0.	0.	0.	0.	1.500	0.3
FACILITIES MAINT + OPERATION	0.	0.	0.	0.540	2.108	4.396	4.396	4.434	4.702	4.721	0.	25.297	5.5
MATERIALS + SERVICES	0.	0.	0.	0.440	2.008	4.396	4.396	4.434	4.652	4.671	0.	24.597	5.4
FULLOW-ON SPARES	0.	0.	0.	0.190	0.758	1.896	1.896	1.896	1.896	1.896	0.	10.428	2.3
HARDWARE REPLACEMENT	0.	0.	0.	0.	0.	0.	0.	0.	0.100	0.100	0.	0.200	0.0
STOCKS CONSUMPTION	0.	0.	0.	0.150	0.750	1.500	1.500	1.500	1.500	1.500	0.	8.400	1.8
ORG EQUIP REPLACEMENT	0.	0.	0.	0.	0.	0.	0.	0.038	0.056	0.075	0.	0.169	0.0
UTILITIES SERVICES	0.	0.	0.	0.100	0.500	1.000	1.000	1.000	1.050	1.050	0.	5.700	1.2
SUBCONTRACT MAINTENANCE	0.	0.	0.	0.	0.	0.	0.	0.	0.050	0.050	0.	0.100	0.0
LEASED FACILITIES	0.	0.	0.	0.100	0.100	0.	0.	0.	0.050	0.050	0.	0.300	0.1

DATE 6/19/63
SYSTEM NO. SAMPLE
RUN NO. 1

TABLE S1S

STRUCTURE ELEMENT COST ESTIMATES OF RUN 1
(IN MILLIONS OF DOLLARS)
FISCAL YEAR

	PRIOR	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	TOTAL	PCT
TOTAL SYSTEM	0.565	34.CCC	66.487	84.269	52.813	43.C48	43.666	47.624	42.220	41.723	2.166	458.781	10C.C

DATE 6/18/63
SYSTEM NO. SAMPLE
RUN NO. 1

TABLE S1F

SUMMARY COST ESTIMATE BY PASS OVER YEARS OF RUN :
(IN MILLIONS OF DOLLARS)

	PASS 1	PASS 2	PASS 3	PASS 4	PASS 5	PASS 6	PASS 7	PASS 8	PASS 9	PASS10	PASS11	TOTAL
RDT&E												
SYSTEM DESIGN & MANAGEMENT	8.4	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	8.4
SUBSYSTEM DEVELOPMENT & TEST	8.6	1.2	0.	0.	0.	0.	0.	0.	0.	0.	0.	9.8
SYSTEM INTEG, TEST & EVAL	23.4	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	23.4
TOTAL RDT&E	40.3	1.2	0.	0.	0.	0.	0.	0.	0.	0.	0.	41.6
INITIAL INVESTMENT												
MISSION EQUIPMENT & AGE	97.3	12.4	0.	0.	0.	0.	0.	0.	0.	0.	0.	109.8
INITIAL SPARES & STOCKS	22.3	2.3	0.	0.	0.	0.	0.	0.	0.	0.	0.	24.6
COMPUTER PROGRAM PRODUCTION	2.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.0
INITIAL TRAINING & TRAVEL	7.7	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.7
FACILITIES	37.9	2.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	39.9
TOTAL INITIAL INVESTMENT	167.2	16.8	0.	0.	0.	0.	0.	0.	0.	0.	0.	184.0
OPERATIONS												
EQUIP REPLACEMENT & PAINT	46.2	5.7	0.	0.	0.	0.	0.	0.	0.	0.	0.	51.8
COMPUTER PROGRAM MAINTENANCE	7.1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.1
COMMUNICATION & EQUIP RENTAL	92.0	0.3	0.	0.	0.	0.	0.	0.	0.	0.	0.	92.3
PERSONNEL	56.8	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	56.8
FACILITIES MAINTENANCE	24.8	0.5	0.	0.	0.	0.	0.	0.	0.	0.	0.	25.3
TOTAL OPERATIONS	226.8	6.5	0.	0.	0.	0.	0.	0.	0.	0.	0.	233.3
TOTAL SYSTEM	434.4	24.4	0.	0.	0.	0.	0.	0.	0.	0.	0.	458.8

TABLE SAP

DATE 6/16/69
SYSTEM NO. SAMPLE
RUN NO. 2

SUMMARY COST ESTIMATE OF RUNS OVER PASSES AND OVER YEARS
(IN MILLIONS OF DOLLARS)

	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5	RUN 6	RUN 7	RUN 8	RUN 9	RUN 10	RUN 11	
RDT&E												
SYSTEM DESIGN & MANAGEMENT	8.4	8.4	C.	0.	C.	C.	C.	C.	0.	C.	0.	0.
SUBSYSTEM DEVELOPMENT & TEST	9.8	9.7	C.	C.	C.	C.	C.	C.	0.	C.	0.	C.
SYSTEM INTEG, TEST & EVAL	23.4	23.4	0.	0.	C.	C.	C.	C.	0.	C.	0.	0.
TOTAL RDT&E	41.6	41.5	C.	C.	C.	C.	C.	C.	0.	C.	0.	C.
INITIAL INVESTMENT												
MISSION EQUIPMENT & AGE	109.8	109.2	0.	0.	0.	C.	0.	C.	0.	C.	0.	C.
INITIAL SPARES & STOCKS	24.6	24.5	C.	0.	C.	C.	C.	C.	0.	C.	0.	0.
COMPUTER PROGRAM REDUCTION	2.0	2.0	C.	0.	C.	C.	C.	C.	0.	C.	0.	0.
INITIAL TRAINING & TRAVEL	7.7	7.7	C.	0.	C.	C.	C.	C.	C.	0.	0.	0.
FACILITIES	39.9	39.9	0.	0.	C.	C.	C.	C.	0.	C.	0.	0.
TOTAL INITIAL INVESTMENT	184.0	183.3	C.	0.	C.	C.	C.	C.	0.	C.	0.	C.
OPERATIONS												
EQUIP REPLACEMENT & PAINT	51.8	51.7	0.	0.	0.	C.	C.	C.	0.	C.	0.	C.
COMPUTER PROGRAM MAINTENANCE	7.1	7.1	C.	0.	C.	C.	C.	C.	0.	0.	0.	0.
COMMUNICATION & EQUIP RENTAL	92.3	92.3	0.	0.	C.	0.	C.	C.	C.	0.	0.	0.
PERSONNEL	56.8	56.8	0.	C.	C.	C.	C.	C.	0.	C.	0.	0.
FACILITIES MAINTENANCE	25.3	25.3	0.	0.	C.	C.	C.	C.	0.	C.	0.	0.
TOTAL OPERATIONS	233.3	233.1	0.	C.	C.	C.	C.	C.	0.	C.	0.	0.
TOTAL SYSTEM	458.8	457.9	0.	C.	0.	C.	C.	C.	0.	C.	0.	C.

EXHIBIT 3

CER PARAMETER CARDS, AND FACTORS AND PERCENTAGES

	Page
CER Parameter Cards	99-106
Factors + Percentages	107-109

Major References in Text - Sections 2.2, 3.2, 3.3, 4.4

CC

SYS NO P0 SCRT0

	CRN0	SS	SEC0	0P	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010				
02	0201	01	1003	02	1004	1009									1	00	00	002
02	0202	01	1014	02	1015	1016									1	00	00	002
02	0203	02	1021	02	1022	1023									1	00	00	002
02	0204	02	1026	02	1027	1028									1	00	00	002
02	0205	02	1032	02	1033	1034									1	00	00	002
02	0206	02	1043	02	1044	1049									1	00	00	002
02	0207	03	1054	02	1055	1056									1	00	00	002
02	0208	03	1059	02	1060	1061									1	00	00	002
02	0209	03	1065	02	1066	1067									1	00	00	002
02	0210	03	1076	02	1077	1082									1	00	00	002
02	0211	04	1087	02	1088	1089									1	00	00	002
02	0212	04	1092	02	1093	1094									1	00	00	002
02	0213	04	1098	02	1099	1100									1	00	00	002
02	0214	04	1109	02	1110	1115									1	00	00	002
02	0215	04	1115	02	1116	1117									1	00	00	002
02	0216	05	1122	02	1123	1124									1	00	00	002
02	0217	05	1127	02	1128	1129									1	00	00	002
02	0218	05	1133	02	1134	1135									1	00	00	002
02	0219	05	1144	02	1145	1150									1	00	00	002
02	0220	06	1155	02	1156	1157									1	00	00	002
02	0221	06	1160	02	1161	1162									1	00	00	002
02	0222	06	1166	02	1167	1168									1	00	00	002
02	0223	06	1177	02	1178	1183									1	00	00	002
02	0224	07	1185	02	1186	1190									1	00	00	002
02	0225	07	1190	02	1191	1195									1	00	00	002
02	0226	07	1196	02	1197	1198									1	00	00	002
02	0227	07	1198	02	1199	1200									1	00	00	002
02	0228	07	1201	02	1202	1203									1	00	00	002
02	0229	10	1205	02	1206	1207									1	00	00	002
02	0230	10	1211	02	1212	1217									1	00	00	002
02	0231	10	1212	02	1213	1214									1	00	00	002
02	0232	10	1214	02	1215	1216									1	00	00	002
02	0233	10	1217	02	1218	1219									1	00	00	002
02	0234	10	1219	02	1220	1221									1	00	00	002
02	0235	11	1242	02	1243	1244									1	00	00	002
02	0236	11	1251	02	1252	1259									1	00	00	002
02	0237	22	3026	02	1186	1197									1	00	00	002
02	0238	22	3036	02	1001	3020									1	00	00	002
02	0239	22	3044	02	1249	1250									1	00	00	002
02	0240	22	3045	02	1190	1198									1	00	00	002
02	0241	21	3001	02	3018	3019									1	00	00	002
02	0242	21	3006	02	3043	3044									1	00	00	002
02	0243	25	4078	02	1019	1036									1	00	00	002
02	0244	25	4086	02	1052	1069									1	00	00	002
02	0245	25	4094	02	1085	1102									1	00	00	002
02	0246	25	4102	02	1120	1137									1	00	00	002
02	0247	25	4110	02	1153	1170									1	00	00	002
02	0248	24	4054	02	1186	1197									1	00	00	002
02	0249	24	4071	02	1249	1250									1	00	00	002
02	0250	23	4008	02	4003	4006									1	00	00	002
02	0251	23	4024	02	4020	4021									1	00	00	002
02	0252	23	4027	02	4003	4011									1	00	00	002

	CE.0	SS	SEQ0	0P	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	SYS	R0	P0	SCRT0
02	0253	23	4028	02	4012	4020									1	00	00	002
02	0254	23	4029	02	4013	4021									1	00	00	002
02	0301	01	1001	03	1002	1003	1014								1	00	00	002
02	0302	02	1017	03	1018	1035	1043								1	00	00	002
02	0303	02	1018	03	1019	1025	1032								1	00	00	002
02	0304	02	1019	03	1020	1021	1024								1	00	00	002
02	0305	02	1035	03	1036	1047	1042								1	00	00	002
02	0306	03	1050	03	1051	1068	1076								1	00	00	002
02	0307	03	1051	03	1052	1058	1065								1	00	00	002
02	0308	03	1052	03	1053	1054	1057								1	00	00	002
02	0309	03	1068	03	1069	1070	1075								1	00	00	002
02	0310	04	1083	03	1084	1101	1109								1	00	00	002
02	0311	04	1084	03	1085	1091	1098								1	00	00	002
02	0312	04	1085	03	1086	1087	1090								1	00	00	002
02	0313	04	1101	03	1102	1103	1108								1	00	00	002
02	0314	05	1118	03	1119	1136	1144								1	00	00	002
02	0315	05	1119	03	1120	1126	1133								1	00	00	002
02	0316	05	1120	03	1121	1122	1125								1	00	00	002
02	0317	05	1136	03	1137	1138	1143								1	00	00	002
02	0318	06	1151	03	1152	1169	1177								1	00	00	002
02	0319	06	1152	03	1153	1159	1166								1	00	00	002
02	0320	06	1153	03	1154	1155	1158								1	00	00	002
02	0321	06	1169	03	1170	1171	1176								1	00	00	002
02	0322	07	1184	03	1185	1196	1201								1	00	00	002
02	0323	07	1186	03	1187	1188	1189								1	00	00	002
02	0324	07	1191	03	1192	1193	1194								1	00	00	002
02	0325	10	1204	03	1205	1211	1222								1	00	00	002
02	0326	10	1207	03	1208	1209	1210								1	00	00	002
02	0327	10	1222	03	1223	1229	1235								1	00	00	002
02	0328	22	3031	03	1206	1213	1218								1	00	00	002
02	0329	22	3048	03	1207	1214	1219								1	00	00	002
02	0330	22	3050	03	1210	1216	1221								1	00	00	002
02	0331	22	3066	03	1227	1233	1239								1	00	00	002
02	0332	22	3067	03	1228	1234	1240								1	00	00	002
02	0333	21	3017	03	3004	3010	3016								1	00	00	002
02	0334	25	4076	03	1031	1041	1043								1	00	00	002
02	0335	25	4084	03	1064	1074	1076								1	00	00	002
02	0336	25	4092	03	1097	1107	1109								1	00	00	002
02	0337	25	4100	03	1132	1142	1144								1	00	00	002
02	0338	25	4108	03	1165	1175	1177								1	00	00	002
02	0339	24	4062	03	1206	1213	1218								1	00	00	002
02	0340	23	4013	03	1210	1216	1221								1	00	00	002
02	0341	23	4032	03	4008	4016	4024								1	00	00	002
02	0401	01	1004	04	1005	1006	1007	1008							1	00	00	002
02	0402	01	1009	04	1010	1011	1012	1013							1	00	00	002
02	0403	02	1025	04	1026	1029	1030	1031							1	00	00	002
02	0404	02	1037	04	1038	1039	1040	1041							1	00	00	002
02	0405	02	1044	04	1045	1046	1047	1048							1	00	00	002
02	0406	03	1058	04	1059	1062	1063	1064							1	00	00	002
02	0407	03	1070	04	1071	1072	1073	1074							1	00	00	002
02	0408	03	1077	04	1078	1079	1080	1081							1	00	00	002
02	0409	04	1091	04	1092	1095	1096	1097							1	00	00	002

	SEC•	SS	SEC•	•P	P•1	P•2	P•3	P•4	P•5	P•6	P•7	P•8	P•9	P•10	SYS R• P• SCRT•
02	0410	04	1103	04	1104	1105	1106	1107							1 00 00 002
02	0411	04	1110	04	1111	1112	1113	1114							1 00 00 002
02	0412	05	1126	04	1127	1130	1131	1132							1 00 00 002
02	0413	05	1138	04	1139	1140	1141	1142							1 00 00 002
02	0414	05	1145	04	1146	1147	1148	1149							1 00 00 002
02	0415	06	1159	04	1160	1163	1164	1165							1 00 00 002
02	0416	06	1171	04	1172	1173	1174	1175							1 00 00 002
02	0417	06	1178	04	1179	1180	1181	1182							1 00 00 002
02	0418	11	1241	04	1242	1249	1250	1251							1 00 00 002
02	0419	11	1244	04	1245	1246	1247	1248							1 00 00 002
02	0420	22	3020	04	3021	3026	3031	3032							1 00 00 002
02	0421	22	3049	04	1208	1209	1215	1220							1 00 00 002
02	0422	22	3060	04	1049	1082	1150	1183							1 00 00 002
02	0423	25	4119	04	4073	4087	4095	4103							1 00 00 002
02	0424	24	4063	04	1208	1209	1215	1220							1 00 00 002
02	0425	23	4006	04	4038	4046	4054	4062							1 00 00 002
02	0426	23	4015	04	4047	4055	4063	4071							1 00 00 002
02	0501	10	1223	05	1224	1225	1226	1227	1228						1 00 00 002
02	0502	10	1229	05	1230	1231	1232	1233	1234						1 00 00 002
02	0503	10	1235	05	1236	1237	1238	1239	1240						1 00 00 002
02	0504	22	3022	05	1020	1053	1086	1121	1154						1 00 00 002
02	0505	22	3023	05	1021	1054	1087	1122	1155						1 00 00 002
02	0506	22	3024	05	1024	1057	1090	1125	1158						1 00 00 002
02	0507	22	3037	05	3038	3039	3040	3041	3042						1 00 00 002
02	0508	22	3038	05	1026	1059	1092	1127	1160						1 00 00 002
02	0509	22	3039	05	1038	1071	1104	1139	1172						1 00 00 002
02	0510	22	3053	05	1044	1077	1110	1145	1178						1 00 00 002
02	0511	22	3055	05	1047	1080	1113	1148	1181						1 00 00 002
02	0512	22	3056	05	1048	1081	1114	1149	1182						1 00 00 002
02	0513	22	3057	05	1049	1082	1115	1150	1183						1 00 00 002
02	0514	22	3069	05	3053	3057	3061	3064	3068						1 00 00 002
02	0515	25	4116	05	4076	4084	4092	4100	4108						1 00 00 002
02	0516	25	4118	05	4078	4086	4094	4102	4110						1 00 00 002
02	0517	25	4120	05	4113	4114	4116	4118	4119						1 00 00 002
02	0601	11	1252	06	1253	1254	1255	1256	1257	1258					1 00 00 002
02	0602	22	3052	06	3037	3043	3044	3045	3048	3051					1 00 00 002
02	0603	24	4060	06	1226	1227	1232	1233	1238	1239					1 00 00 002
02	0604	23	4016	06	4009	4010	4011	4012	4013	4015					1 00 00 002
02	0901	22	3065	09	1224	1225	1226	1230	1231	1232	1236	1237	1238		1 00 00 002
02	0902	17	1260	09	1001	1017	1050	1083	1118	1151	1184	1204	1241		1 00 00 002
02	1001	22	3021	10	1019	1036	1052	1069	1085	1102	1120	1137	1153	1170	1 00 00 002
02	1002	22	3040	10	1029	1039	1062	1072	1095	1105	1130	1140	1163	1173	1 00 00 002
02	1003	22	3041	10	1030	1040	1063	1073	1096	1106	1131	1141	1164	1174	1 00 00 002
02	1004	22	3042	10	1031	1041	1064	1074	1097	1107	1132	1142	1165	1175	1 00 00 002
02	1005	22	3043	10	1032	1042	1065	1075	1098	1108	1133	1143	1166	1176	1 00 00 002
02	1006	22	3054	10	1045	1046	1078	1079	1111	1112	1146	1147	1179	1180	1 00 00 002
02	1007	23	4012	10	1031	1041	1064	1074	1097	1107	1132	1142	1165	1175	1 00 00 002
02	1101	02	1023	02	2124	1022									1 00 00 002
02	1102	02	1036	02	2130	1019									1 00 00 002
02	1103	02	1038	02	2132	1026									1 00 00 002
02	1104	02	1039	02	2133	1029									1 00 00 002
02	1105	02	1040	02	2134	1030									1 00 00 002

	CE#0	SS	SEC0	0P	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010				
02	1106	02	1041	02	2135	1031									1	00	00	002
02	1107	02	1042	02	2136	1032									1	00	00	002
02	1109	02	1046	02	2138	1045									1	00	00	002
02	1109	03	1056	02	2141	1055									1	00	00	002
02	1110	03	1069	02	2147	1052									1	00	00	002
02	1111	03	1071	02	2149	1059									1	00	00	002
02	1112	03	1072	02	2150	1062									1	00	00	002
02	1113	03	1073	02	2151	1063									1	00	00	002
02	1114	03	1074	02	2152	1064									1	00	00	002
02	1115	03	1075	02	2153	1065									1	00	00	002
02	1116	03	1079	02	2155	1078									1	00	00	002
02	1117	04	1089	02	2158	1088									1	00	00	002
02	1118	04	1102	02	2164	1085									1	00	00	002
02	1119	04	1104	02	2166	1092									1	00	00	002
02	1120	04	1105	02	2167	1095									1	00	00	002
02	1121	04	1106	02	2168	1096									1	00	00	002
02	1122	04	1107	02	2169	1097									1	00	00	002
02	1123	04	1108	02	2170	1098									1	00	00	002
02	1124	04	1112	02	2172	1111									1	00	00	002
02	1125	05	1124	02	2175	1123									1	00	00	002
02	1126	05	1137	02	2181	1120									1	00	00	002
02	1127	05	1139	02	2183	1127									1	00	00	002
02	1128	05	1140	02	2184	1130									1	00	00	002
02	1129	05	1141	02	2185	1131									1	00	00	002
02	1130	05	1142	02	2186	1132									1	00	00	002
02	1131	05	1143	02	2187	1133									1	00	00	002
02	1132	05	1147	02	2189	1146									1	00	00	002
02	1133	06	1157	02	2192	1156									1	00	00	002
02	1134	06	1170	02	2198	1053									1	00	00	002
02	1135	06	1172	02	2200	1160									1	00	00	002
02	1136	06	1173	02	2201	1163									1	00	00	002
02	1137	06	1174	02	2202	1164									1	00	00	002
02	1138	06	1175	02	2203	1165									1	00	00	002
02	1139	06	1176	02	2204	1166									1	00	00	002
02	1140	06	1180	02	2206	1179									1	00	00	002
02	1141	11	1250	02	2118	1249									1	00	00	002
02	1201	01	1014	03	2101	1002	1003								1	00	00	002
02	1202	10	1227	03	2106	1224	1225								1	00	00	002
02	1203	10	1228	03	2107	1224	1225								1	00	00	002
02	1204	10	1233	03	2108	1230	1231								1	00	00	002
02	1205	10	1234	03	2109	1230	1231								1	00	00	002
02	1206	10	1239	03	2110	1236	1237								1	00	00	002
02	1207	10	1240	03	2111	1236	1237								1	00	00	002
02	1301	02	1019	02	2123	1026									1	00	00	002
02	1302	02	1029	02	2125	1026									1	00	00	002
02	1303	02	1030	02	2126	1026									1	00	00	002
02	1304	02	1033	02	2128	1026									1	00	00	002
02	1305	02	1034	02	2129	1033									1	00	00	002
02	1306	03	1052	02	2140	1059									1	00	00	002
02	1307	03	1062	02	2142	1059									1	00	00	002
02	1308	03	1063	02	2143	1059									1	00	00	002
02	1309	03	1066	02	2145	1059									1	00	00	002

CC	LOC	SS	SEC	OP	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	SYS	R	P	SORT
02	1310	03	1067	02	2146	1066									1	00	00	002
02	1311	04	1085	02	2157	1092									1	00	00	002
02	1312	04	1095	02	2159	1092									1	00	00	002
02	1313	04	1096	02	2160	1092									1	00	00	002
02	1314	04	1099	02	2152	1092									1	00	00	002
02	1315	04	1100	02	2163	1099									1	00	00	002
02	1316	05	1120	02	2174	1127									1	00	00	002
02	1317	05	1130	02	2176	1127									1	00	00	002
02	1318	05	1131	02	2177	1127									1	00	00	002
02	1319	05	1134	02	2179	1127									1	00	00	002
02	1320	05	1135	02	2180	1134									1	00	00	002
02	1321	06	1153	02	2191	1160									1	00	00	002
02	1322	06	1163	02	2193	1160									1	00	00	002
02	1323	06	1164	02	2194	1160									1	00	00	002
02	1324	06	1167	02	2196	1160									1	00	00	002
02	1325	06	1168	02	2197	1167									1	00	00	002
02	1326	07	1187	02	2102	1191									1	00	00	002
02	1327	07	1195	02	2103	1191									1	00	00	002
02	1328	07	1197	02	2104	1198									1	00	00	002
02	1329	07	1200	02	2105	1199									1	00	00	002
02	1401	11	1243	04	2113	1245	1246	1247							1	00	00	002
02	1501	02	1045	02	2137	1026									1	00	00	002
02	1502	02	1047	02	2139	1026									1	00	00	002
02	1503	03	1078	02	2154	1059									1	00	00	002
02	1504	03	1080	02	2156	1059									1	00	00	002
02	1505	04	1111	02	2171	1092									1	00	00	002
02	1506	04	1113	02	2173	1092									1	00	00	002
02	1507	05	1146	02	2188	1127									1	00	00	002
02	1508	05	1148	02	2190	1127									1	00	00	002
02	1509	06	1179	02	2205	1160									1	00	00	002
02	1510	06	1181	02	2207	1160									1	00	00	002
02	1511	11	1253	02	2119	1244									1	00	00	002
02	1512	11	1254	02	2120	1244									1	00	00	002
02	1513	11	1255	02	2121	1249									1	00	00	002
02	1514	11	1256	02	2122	1250									1	00	00	002
02	1601	07	1188	01	2009										1	00	00	002
02	1602	07	1189	01	2009										1	00	00	002
02	1603	07	1191	01	2010										1	00	00	002
02	1604	07	1192	01	2011										1	00	00	002
02	1605	07	1193	01	2011										1	00	00	002
02	1606	07	1199	01	2012										1	00	00	002
02	1607	10	1210	01	2015										1	00	00	002
02	1608	10	1216	01	2015										1	00	00	002
02	1609	10	1221	01	2015										1	00	00	002
02	1610	10	1224	01	2001										1	00	00	002
02	1611	10	1225	01	2008										1	00	00	002
02	1612	10	1226	01	2002										1	00	00	002
02	1613	10	1230	01	2001										1	00	00	002
02	1614	10	1231	01	2008										1	00	00	002
02	1615	10	1232	01	2002										1	00	00	002
02	1616	10	1236	01	2001										1	00	00	002
02	1617	10	1237	01	2008										1	00	00	002

	CER•	SS	SEQ•	•P	P•1	P•2	P•3	P•4	P•5	P•6	P•7	P•8	P•9	P•10				
02	1618	10	1238	01	2002										1	00	00	002
02	1701	01	1006	02	2003	2004									1	00	00	002
02	1702	01	1011	02	2003	2004									1	00	00	002
02	1703	02	1020	02	2003	2004									1	00	00	002
02	1704	02	1024	02	2003	2004									1	00	00	002
02	1705	03	1053	02	2003	2004									1	00	00	002
02	1706	03	1057	02	2003	2004									1	00	00	002
02	1707	04	1086	02	2003	2004									1	00	00	002
02	1708	04	1090	02	2003	2004									1	00	00	002
02	1709	05	1121	02	2003	2004									1	00	00	002
02	1710	05	1125	02	2003	2004									1	00	00	002
02	1711	06	1154	02	2003	2004									1	00	00	002
02	1712	06	1158	02	2003	2004									1	00	00	002
02	1713	07	1188	02	2011	2006									1	00	00	002
02	1714	07	1189	02	2011	2006									1	00	00	002
02	1715	07	1191	02	2011	2006									1	00	00	002
02	1716	07	1194	02	2011	2006									1	00	00	002
02	1717	07	1199	02	2011	2006									1	00	00	002
02	1718	07	1202	02	2011	2006									1	00	00	002
02	1719	07	1203	02	2011	2006									1	00	00	002
02	1720	10	1206	02	2003	2004									1	00	00	002
02	1721	10	1213	02	2003	2004									1	00	00	002
02	1722	10	1218	02	2003	2004									1	00	00	002
02	1801	01	1002	03	2001	2002	2003								1	00	00	002
02	1802	01	1005	03	2001	2002	2003								1	00	00	002
02	1803	01	1008	03	2003	2004	2006								1	00	00	002
02	1804	01	1010	03	2001	2002	2003								1	00	00	002
02	1805	01	1013	03	2003	2004	2006								1	00	00	002
02	1806	01	1015	03	2001	2002	2007								1	00	00	002
02	1807	01	1016	03	2001	2002	2003								1	00	00	002
02	1901	10	1209	01	2016										1	00	00	002
02	1902	11	1249	01	2017										1	00	00	002
02	2001	10	1208	01	2013										1	00	00	002
02	2002	10	1215	01	2018										1	00	00	002
02	2003	10	1220	01	2019										1	00	00	002
02	2101	01	1007	08	2003	2004	2208	1026	1059	1092	1127	1160			1	00	00	002
02	2102	01	1012	08	2003	2004	2209	1026	1059	1092	1127	1160			1	00	00	002
02	2201	02	1031	06	2001	2008	2003	2004	2127	1026					1	00	00	002
02	2202	03	1064	06	2001	2008	2003	2004	2144	1059					1	00	00	002
02	2203	04	1097	06	2001	2008	2003	2004	2161	1092					1	00	00	002
02	2204	05	1132	06	2001	2008	2003	2004	2178	1127					1	00	00	002
02	2205	06	1165	06	2001	2008	2003	2004	2195	1160					1	00	00	002
02	2301	01	1004	10	2001	2002	2003	2004	2208	1026	1059	1092	1127	1160	1	00	00	002
02	2302	01	1009	10	2001	2002	2003	2004	2209	1026	1059	1092	1127	1160	1	00	00	002
02	2501	11	1248	07	2114	2115	2116	2117	1245	1246	1247				1	00	00	002
02	2601	22	3018	01	1002										1	00	00	002
02	2602	22	3019	01	1014										1	00	00	002
02	2603	22	3027	01	1187										1	00	00	002
02	2604	22	3028	01	1188										1	00	00	002
02	2605	22	3029	01	1189										1	00	00	002
02	2606	22	3030	01	1197										1	00	00	002
02	2607	22	3032	01	1243										1	00	00	002

	CE#•	SS	SEQ•	#P	P•1	P•2	P•3	P•4	P•5	P•6	P•7	P•8	P•9	P•10	SYS R• P• SORT•
02	2638	22	3033	01	1003										1 00 00 002
02	2639	22	3034	01	1004										1 00 00 002
02	2610	22	3035	01	1009										1 00 00 002
02	2611	22	3046	01	1190										1 00 00 002
02	2612	22	3047	01	1198										1 00 00 002
02	2613	22	3051	01	1244										1 00 00 002
02	2614	22	3059	01	1116										1 00 00 002
02	2615	22	3059	01	1117										1 00 00 002
02	2615	22	3061	01	1201										1 00 00 002
02	2617	22	3062	01	1202										1 00 00 002
02	2618	22	3063	01	1203										1 00 00 002
02	2619	22	3064	01	1222										1 00 00 002
02	2620	22	3068	01	1251										1 00 00 002
02	2621	21	3002	01	3020										1 00 00 002
02	2622	21	3003	01	3033										1 00 00 002
02	2623	21	3004	01	3036										1 00 00 002
02	2624	21	3005	01	3037										1 00 00 002
02	2625	21	3007	01	3045										1 00 00 002
02	2626	21	3008	01	3048										1 00 00 002
02	2627	21	3009	01	3051										1 00 00 002
02	2628	21	3010	01	3052										1 00 00 002
02	2629	21	3011	01	3053										1 00 00 002
02	2630	21	3012	01	3061										1 00 00 002
02	2631	21	3013	01	3057										1 00 00 002
02	2632	21	3014	01	3064										1 00 00 002
02	2633	21	3015	01	3068										1 00 00 002
02	2634	21	3016	01	3069										1 00 00 002
02	2635	25	4080	01	1017										1 00 00 002
02	2636	25	4088	01	1050										1 00 00 002
02	2637	25	4096	01	1083										1 00 00 002
02	2638	25	4104	01	1118										1 00 00 002
02	2639	25	4112	01	1151										1 00 00 002
02	2640	25	4113	01	4105										1 00 00 002
02	2641	25	4114	01	4106										1 00 00 002
02	2642	24	4038	01	1001										1 00 00 002
02	2643	24	4040	01	4038										1 00 00 002
02	2644	24	4041	01	4113										1 00 00 002
02	2645	24	4042	01	4114										1 00 00 002
02	2646	24	4044	01	4116										1 00 00 002
02	2647	24	4046	01	4118										1 00 00 002
02	2648	24	4047	01	4119										1 00 00 002
02	2649	24	4048	01	4120										1 00 00 002
02	2650	24	4052	01	1201										1 00 00 002
02	2651	24	4056	01	1184										1 00 00 002
02	2652	24	4064	01	1204										1 00 00 002
02	2653	24	4067	01	1242										1 00 00 002
02	2654	24	4068	01	1251										1 00 00 002
02	2655	24	4072	01	1241										1 00 00 002
02	2656	23	4003	01	1243										1 00 00 002
02	2657	23	4009	01	4041										1 00 00 002
02	2658	23	4010	01	4042										1 00 00 002
02	2659	23	4011	01	1244										1 00 00 002

	Cde•	SS	SEQ•	•P	P•1	P•2	P•3	P•4	P•5	P•6	P•7	P•F	P•9	P•10	SYS	R•	P•	SORT•
02	2660	23	4025	01	4009										1	00	00	002
02	2661	23	4026	01	4010										1	00	00	002
02	2662	23	4030	01	4006										1	00	00	002
02	2663	23	4031	01	4015										1	00	00	002
02	2701	02	1022	02	2003	2004									1	00	00	002
02	2702	03	1055	02	2003	2004									1	00	00	002
02	2703	04	1088	02	2003	2004									1	00	00	002
02	2704	05	1123	02	2003	2004									1	00	00	002
02	2705	06	1156	02	2003	2004									1	00	00	002
02	2801	23	4021	02	4013	4061									1	00	00	002
02	2802	25	4106	02	1151	1151									1	00	00	002
02	2901	24	4055	03	4052	4054	1184								1	00	00	002
02	2902	25	4079	03	4076	4078	1017								1	00	00	002
02	2903	25	4087	03	4084	4086	1050								1	00	00	002
02	2904	25	4095	03	4092	4094	1083								1	00	00	002
02	2905	25	4103	03	4100	4102	1118								1	00	00	002
02	3001	22	3025	04	3022	3023	3024	3021							1	00	00	002
02	3101	25	4105	03	4108	4110	1151								1	00	00	002
02	3301	23	4020	05	4012	4044	4052	4060	4068						1	00	00	002
02	3302	24	4061	05	4060	1210	1216	1221	1222						1	00	00	002

	FAC•	VALUE-INCR •IN	DESCRIPTION	
03	001		DOLLARS/MAN-YEAR - AF OFFICERS	$ CC CC CC4
03	002		DOLLARS/MAN-YEAR - AF CIVILIANS	$ CC CC CC4
03	003		DOLLARS/MAN-YEAR - CONTRACTOR ENGINEERS	$ CC OC CC4
03	004		DOLLARS/MAN-YEAR - CONTRACTOR TECHNICIANS	$ CO OC CC4
03	005		ONE	$ CC OC CC4
03	006		DOLLARS/COMPUTER-HOUR	$ CC CC CC4
03	007		DOLLARS/MAN-YEAR - CONTRACTOR ADMINISTRATORS	$ CC CC CC4
03	008		DOLLARS/MAN-YEAR - AF AIRMEN	$ CC OC CC4
03	009		DOLLARS/INSTRUCTION - SIM • DATA REDUCTION PROGRAMS	$ CC CC CC4
03	010		DOLLARS/INSTRUCTION - MISSION PROGRAM PRODUCTION	$ CC CC CC4
03	011		DOLLARS/MAN-YEAR - PROGRAMMERS	$ CC OC CC4
03	01.		DOLLARS/INSTRUCTION - UTIL • MAINT PROGRAM PRODUCTION	$ CC OC CC4
03	013		DOLLARS/MAN-MONTH - TRAINING - OPERATIONAL PERSONNEL	$ OC CC CC4
03	014		DOLLARS/MAN-MONTH - TRAINING AID COST	$ CC CC CC4
03	015		DOLLARS/MAN TRAVEL • TRANSPORTATION (ZI)	$ CO OO CC4
03	016		DOLLARS/OPERATOR POSITION - MANPOWERS	$ CO OC CC4
03	017		DOLLARS/MAN -INITIAL STOCKS	$ CC CC CC4
03	018		DOLLARS/MAN-MONTH - TRAINING - MAINTENANCE PERSONNEL	$ CC CC CC4
03	019		DOLLARS/MAN-MONTH - TRAINING - SUPPORT PERSONNEL	$ CO OO CC4
03	101		SYS MANAGEMENT AS PCT OF SYS DESIGN • SYS INTEGRATION	$ OO OC CC4
03	102		MISSION PROG PLANNING AS PCT OF OPER PROG PRODUCTION	$ CO CC CC4
03	103		OPER PROGRAM DATA AS PCT OF OPER PROGRAM PRODUCTION	$ CC CC CC4
03	104		UTIL • MAINT PROG PLANNING AS PCT OF L • M PROG PROD	$ OO OO CC4
03	105		UTIL • MAINT PROG DATA AS PCT OF L • M PROG PROD	$ CO OO CC4
03	106		OPER PERS ATTRITION TRAINING AS PCT OF OPER PERS P•A	$ CC CC CC4
03	107		OPER PERS ATTR TVL • TRANS AS PCT OF OPER PERS P•A	$ CC OC CC4
03	108		MAINT PERS ATTRITION TRAINING AS PCT OF MAINT P•A	$ CO OO CC4
03	109		MAINT PERS ATTR TVL • TRANS AS PCT OF MAINT PERS P•A	$ OC OO CC4
03	110		SUPP PERS ATTRITION TRAINING AS PCT OF SUPP PERS P•A	$ CC CC CC4
03	111		SUPP PERS ATTR TVL • TRANS AS PCT OF SUPP PERS P•A	$ OC OO CC4
03	112		TEN PERCENT	$ CO CO CC4
03	113		FACILITIES R•D AS PCT OF INVEST COST LESS CONTRAS	$ CC OO CC4
03	114		FACILITIES SITE EXPLORATION AS PCT OF FACIL PROCUR	$ CC OC CC4
03	115		FACILITIES CONSTRUC SUPER AS PCT OF FACIL PROCUREMENT	$ CC OC CC4
03	116		FACILITIES OVERHEAD • PROFIT AS PCT OF FACIL PROCUR	$ CC OO CC4
03	117		FACILITIES CONTINGENCIES AS PCT OF FACIL PROCUREMENT	$ CC OO CC4
03	118		ORG EQUIPMENT AS PCT OF INITIAL STOCKS	$ CC CC CC4
03	119		FACILITIES FOLLOW-ON SPARES AS PCT OF PROCUREMENT	$ CC OC CC4
03	120		FACILITIES HARDWARE REPLACEMENT AS PCT OF PROCUREMENT	$ CC OO CC4
03	121		STOCKS CONSUMPTION AS PCT OF INITIAL STOCKS	$ CC OC CC4
03	122		ORG EQUIPMENT REPLACEMENT AS PCT OF ORG EQUIPMENT	$ CC CC CC4
03	123		DATA PROC- DEVELOPMENT AS PCT OF PRIME EQUIP PROCUR	$ CC CC CC4
03	124		DATA PROC- DEVEL TOOLING AS PCT OF PCCH-UPS • PRCTCS	$ CO OO CC4
03	125		DATA PROC- DATA AS PCT OF PRIME EQUIP PROCUREMENT	$ CC CC CC4
03	126		DATA PROC- PRIME EQUIP TRANS AS PCT OF PRIME EQUIP	$ CC CC CC4
03	127		DATA PROC- INSTALLATION AS PCT OF PRIME EQUIP PROCUR	$ CC CC CC4
03	128		DATA PROC- INITIAL SPARES AS PCT OF PRIME EQUIP PROC	$ CC CC CC4
03	129		DATA PROC- SPARES TRANS AS PCT OF INITIAL SPARES	$ CO OC CC4
03	130		DATA PROC- AGE DEVEL AS PCT OF PRIME EQUIP DEVEL	$ CC CC CC4
03	131		DATA PROC- AGE PROCUR • INSTALL AS PCT OF PME P • I	$ CC OC CC4
03	132		DATA PROC- AGE EQUIPMENT AS PCT OF PRIME EQUIPMENT	$ CC OC CC4
03	133		DATA PROC- AGE DATA AS PCT OF PRIME EQUIPMENT DATA	$ CC CC CC4

	FAC•	VALUE-INCR •IN	DESCRIPTICN			
03	134		DATA PRCC- AGE TRANS AS PCT CF PRIME ECLIPPENT TRANS	S	CC	CC CC4
03	135		DATA PROC- AGE INSTALLATICN AS PCT OF PME INSTALL	S	CC	CC CC4
03	136		DATA PRCC- ACE SPARES AS PCT CF PRIME ECLIP IN SPARES	S	CC	CC CC4
03	137		DATA PRCC- FCLLCW-CN SPARES AS PCT CF PRIME ECLIP PRC	S	CC	OC CC4
03	138		DATA PRCC- FCLLCW-CN SPARES TRANS AS PCT CF FCL-CN SP	S	CC	CC CC4
03	139		DATA PRCC- ECUIP REPLACEMENT AS PCT OF PRIME EC PROC	S	CC	CC CC4
03	140		DATA PRES- DEVELCPMENT AS PCT CF PRIME ECLIP PROCUR	S	CC	CC CC4
03	141		DATA PRES- DEVEL TCCLING AS PCT CF MCCK-UPS • PRCTCS	S	CC	OC CC4
03	142		DATA PRES- DATA AS PCT CF PRIME ECUIP PRCCLREMENT	S	OC	OC CC4
03	143		DATA PRES- PRIME ECUIP TRANS AS PCT OF PRIME ECUIP	S	CC	CC CC4
03	144		DATA PRES- INSTALLATICN AS PCT CF PRIME ECUIP PRCCUR	S	CC	CC CC4
03	145		DATA PRES- INITIAL SPARES AS PCT CF PRIME ECLIP PRCC	S	CO	OC CC4
03	146		DATA PRES- SPARES TRANS AS PCT CF INITIAL SPARES	S	CC	CC CC4
03	147		DATA PRES- AGE DEVEL AS PCT CF PRIME ECLIP DEVEL	S	CC	CC CC4
03	148		DATA PRES- AGE PRCCLR • INSTALL AS PCT CF PME P • I	S	CC	CO CC4
03	149		DATA PRES- AGE EQUIPPENT AS PCT CF PRIME ECLIPPENT	S	CO	OC CC4
03	150		DATA PRES- AGE DATA AS PCT CF PRIME ECLIPPENT DATA	S	CC	CC CC4
03	151		DATA PRES- AGE TRANS AS PCT CF PRIME ECUIPPENT TRANS	S	CC	CC CC4
03	152		DATA PRES- AGE INSTALLATICN AS PCT CF PME INSTALL	S	CC	OO CC4
03	153		DATA PRES- AGE SPARES AS PCT CF PRIME ECUIP IN SPARES	S	CC	OO CC4
03	154		DATA PRES- FCLLCW-CN SPARES AS PCT CF PRIME ECLIP PRC	S	CC	CC CC4
03	155		DATA PRES- FCLLCW-ON SPARES TRANS AS PCT CF FCL-CN SP	S	CC	CC CC4
03	156		DATA PRES- EQUIP REPLACEMENT AS PCT CF PRIME EC PRCC	S	CO	OO CC4
03	157		COMM- DEVELCPMENT AS PCT CF PRIME EQUIP PRCCLREMENT	S	CO	OC CC4
03	158		COMM- CEVEL TCCLING AS PCT CF MCCK-UPS • PRCTCS	S	CC	CC CC4
03	159		COMM- DATA AS PCT OF PRIME EQUIP PROCLREMENT	S	CC	CC CC4
03	160		COMM- PRIME EQUIP TRANS AS PCT CF PRIME EQUIPPENT	S	CC	OO CC4
03	161		COMP- INSTALLATICN AS PCT OF PRIME EQUIP PRCCLREMENT	S	OO	OC CC4
03	162		COMM- INITIAL SPARES AS PCT OF PRIME ECLIP PRCCUR	S	CC	CC CC4
03	163		COMM- SPARES TRANS AS PCT CF INITIAL SPARES	S	CC	CC CC4
03	164		COMM- AGE CEVEL AS PCT CF PRIME EQUIPPENT CEVEL	S	OO	OO CC4
03	165		COMM- AGE PRCCUR • INSTALL AS PCT CF PME P •I	S	CC	OO CC4
03	166		COMM- AGE EQUIPMENT AS PCT CF PRIME ECLIPPENT	S	CC	CC CC4
03	167		COMM- AGE DATA AS PCT CF PRIME ECLIPMENT DATA	S	CC	CC CC4
03	168		COMM- AGE TRANS AS PCT CF PRIME ECUIPPENT TRANS	S	OO	OO CC4
03	169		COMM- AGE INSTALLATICN AS PCT CF PME INSTALL	S	OO	OO CC4
03	170		COMM- AGE SPARES AS PCT CF PRIME ECUIP INIT SPARES	S	CC	CC CC4
03	171		COMM- FOLLOW-CN SPARES AS PCT CF PRIME ECUIP PRO	S	CC	CC CC4
03	172		COMM- FCLLOW-CN SPARES TRANS AS PCT CF FCLLCW-CN SP	S	OC	OO CC4
03	173		COPP- EQUIP REPLACEMENT AS PCT CF PRIME ECLIP PRCC	S	CO	OO CC4
03	174		DATA ACQU- DEVELLOPPENT AS PCT CF PRIME ECLIP PRCCUR	S	CC	OC CC4
03	175		DATA ACQU- DEVEL TCOLING AS PCT CF MOCK-UPS • PRCTCS	S	CC	CO CC4
03	176		DATA ACQU- DATA AS PCT CF PRIME ECLIP PRCCLREMENT	S	CO	CO CC4
03	177		DATA ACQU- PRIME EQUIP TRANS AS PCT CF PRIME EQUIP	S	CC	CO CC4
03	178		DATA ACQU- INSTALLATICN AS PCT CF PRIME ECUIP PRCCUR	S	CC	OC CC4
03	179		DATA ACQU- INITIAL SPARES AS PCT CF PRIME ECLIP PRCC	S	CC	CO CC4
03	180		DATA ACQU- SPARES TRANS AS PCT CF INITIAL SPARES	S	OO	OO CC4
03	181		DATA ACQU- AGE DEVEL AS PCT CF PRIME ECUIP DEVEL	S	CO	OO CC4
03	182		DATA ACQU- AGE PRCCUR • INSTALL AS PCT CF PME P • I	S	CC	CC CC4
03	183		DATA ACQU- AGE ECUIPPENT AS PCT CF PRIME ECLIPPENT	S	CC	CO CC4
03	184		DATA ACQU- AGE DATA AS PCT OF PRIME EQUIPPENT DATA	S	CC	OC CC4
03	185		DATA ACQU- AGE TRANS AS PCT CF PRIME ECUIPPENT TRANS	S	CC	OC CC4

	FAC.	VALUE-INCR	.IN	DESCRIPTION	SYS	R.	P.	SCRT.
03	186			DATA ACQU- AGE INSTALLATION AS PCT OF PME INSTALL	S	CC	CC	CC4
03	187			DATA ACQU- AGE SPARES AS PCT OF PRIME EQUIP IN SPARES	S	CC	CC	CC4
03	188			DATA ACQU- FOLLOW-ON SPARES AS PCT OF PRIME EQUIP PRC	S	CC	CC	CC4
03	189			DATA ACQU- FOLLOW-ON SPARES TRANS AS PCT OF FOL-ON SP	S	CC	CC	CC4
03	190			DATA ACQU- EQUIP REPLACEMENT AS PCT OF PRIME EQ PROC	S	CC	CC	CC4
03	191			VEHICLES- DEVELOPMENT AS PCT OF PRIME EQUIP PROCUR	S	CC	CC	CC4
03	192			VEHICLES- DEVEL TOOLING AS PCT OF PROG-LPS + PROTOS	S	CC	CC	CC4
03	193			VEHICLES- DATA AS PCT OF PRIME EQUIP PROCUREMENT	S	CC	00	CC4
03	194			VEHICLES- PRIME EQUIP TRANS AS PCT OF PRIME EQUIP	S	CC	CC	CC4
03	195			VEHICLES- INSTALLATION AS PCT OF PRIME EQUIP PROCUR	S	CC	CC	CC4
03	196			VEHICLES- INITIAL SPARES AS PCT OF PRIME EQUIP PROC	S	CC	00	CC4
03	197			VEHICLES- SPARES TRANS AS PCT OF INITIAL SPARES	S	CC	00	CC4
03	198			VEHICLES- AGE DEVEL AS PCT OF PRIME EQUIP DEVEL	S	CC	CC	CC4
03	199			VEHICLES- AGE PROCUR + INSTALL AS PCT OF PME P + I	S	CC	00	CC4
03	200			VEHICLES- AGE EQUIPMENT AS PCT OF PRIME EQUIPMENT	S	CC	CC	CC4
03	201			VEHICLES- AGE DATA AS PCT OF PRIME EQUIPMENT DATA	S	00	00	CC4
03	202			VEHICLES- AGE TRANS AS PCT OF PRIME EQUIPMENT TRANS	S	00	CC	CC4
03	203			VEHICLES- AGE INSTALLATION AS PCT OF PME INSTALL	S	CC	00	CC4
03	204			VEHICLES- AGE SPARES AS PCT OF PRIME EQUIP IN SPARES	S	CC	CC	CC4
03	205			VEHICLES- FOLLOW-ON SPARES AS PCT OF PRIME EQUIP PRC	S	00	00	CC4
03	206			VEHICLES- FOLLOW-ON SPARES TRANS AS PCT OF FOL-ON SP	S	00	00	CC4
03	207			VEHICLES- EQUIP REPLACEMENT AS PCT OF PRIME EQ PROC	S	CC	00	CC4
03	208			MONTHLY SPARES CONSUMP DURING INTRA-SYS INTEG TESTS	S	00	CC	CC4
03	209			MONTHLY SPARES CONSUMP DURING INTER-SYS INTEG TESTS	S	CC	00	CC4

EXHIBIT 4

EXAMPLES OF FORMATS OF THE 1401 LISTING

	Page
1401 Listing	111

Major References in Text - Sections 4.2, 4.6

CC PAGE NO 1 SYS R• P• SERT•

	MON	DAY	YR	•SYS	DESCRIPTION
00	6	18	63	1	

	SYSTEM	RUNS	•PS	N	NUMBER OF ELEMENTS IN SUBSYSTEM 1	2	3	4	5	6	7	8	9	DEC R	TBL R •	
01	SAMPLE	6	2	63	16	33	33	35	33	33	20	37	19	1	SAP	S CC C0 CC1

	CER•	SS	SEQ•	•P	P•1	P•2	P•3	P•4	P•5	P•6	P•7	P•P	P•9	P•1C	
02	0902	12	1260	09	1001	1017	1050	1083	1118	1151	1184	1204	1241		S 00 C0 CC2

	FAC•	VALUE-INCR	•IN	DESCRIPTION	
03	010	3.200E 01		DOLLARS/INSTRUCTION - MISSION PROGRAM PRODUCTION	S C0 00 004

	SYSTEM	RUN•	P•	TABLE A P •D TB•	TABLE B P •D TB•	TABLE C P •D TB•	TABLE D P •D TB•	TABLE E P •D TB•	TABLE S P •D TB•	TABLE P P •C Te•	•F IN	•F CH	•E CH	
04	SAMPLE	1		1 1 1 A	1 3 1 B	1 1 1 C	1 1 1 D	1 1 1 E	1 3 1 S	1 1 1 P				S C1 00 0CC
05	SAMPLE	1	1	1 1 11A					1 3 11S					S 01 01 C0C

	SEQ•	A	SS	CER•	C•	Y	Z	PR	YRS	N	N+1	N+2	N+3	N+4	A+5	N+6	N+7	N+8	N+9	
06	1027	7	02	0101	1	4	0								35C	700				S 01 C2 1C1

	FAC•	VALUE-INCR	•IN	DESCRIPTION	
-1	003	5.000E 03	3		S 02 00 C01
-3	129	7.000E-02		DATA PROC- SPARES TRANS AS PCT OF INITIAL SPARES	S 02 00 C03

	P•	•REV	
07	02	01	S 02 02 C07

	SEQ•	B	SS	CER•	C•	Y	Z	PR	YRS	N	N+1	N+2	N+3	N+4	A+5	N+6	N+7	N+8	N+9	
-6	1027	7	02	0101	1	6	0								1C					S C2 C2 1C1

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EXHIBIT 5

USED-ON TABLE

	Page
Table Sequence Numbers	113-117
Used-On Table	118-131

Major Reference in Text - Section 4.5

TABLE A
SUMMARY COST ESTIMATE

ELEMENT NAME	SEQ NO
RDT+E	
SYSTEM DESIGN + MANAGEMENT	3001
SUBSYSTEM DEVELOPMENT + TEST	3002
SYSTEM INTEG. TEST + EVAL	3003
TOTAL RDT+E	3004
INITIAL INVESTMENT	
MISSION EQUIPMENT + AGE	3005
INITIAL SPARES + STOCKS	3006
COMPUTER PROGRAM PRODUCTION	3007
INITIAL TRAINING + TRAVEL	3008
FACILITIES	3009
TOTAL INITIAL INVESTMENT	3010
OPERATIONS	
EQUIP REPLACEMENT + MAINT	3011
COMPUTER PROGRAM MAINTENANCE	3012
COMMUNICATION + EQUIP RENTAL	3013
PERSONNEL	3014
FACILITIES MAINTENANCE	3015
TOTAL OPERATIONS	3016
TOTAL SYSTEM	3017

TABLE B
DETAILED COST ESTIMATE

ELEMENT NAME	SEQ NO
RDT+E	
SYSTEM DESIGN	3018
SYSTEM MANAGEMENT	3019
SUB-SYSTEM DEVELOPMENT	3020
HARDWARE SUBSYSTEMS	3021
ANALYSIS + DESIGN	3022
FABRICATION FOR TEST	3023
TEST + EVALUATION	3024
AGE + NON-SUBDIVIDED	3025
COMPUTER PROGRAMS	3026
MASTER PROGRAM PLANNING	3027
EXPER + PROTOTYPE PROGS	3028
SIM + DATA REDUC PROGS	3029
UTIL-MAINT PROG PLANNING	3030
PERSONNEL	3031
FACILITIES	3032
SYSTEM INTEG. TEST + EVAL	3033
INTRA-SYSTEM INTEGRATION	3034
INTER-SYSTEM INTEGRATION	3035
TOTAL RDT+E	3036
INITIAL INVESTMENT	
MISSION EQUIPMENT + AGE	3037
PRIME EQUIPMENT	3038
AGE	3039
DATA	3040
FIRST DESTINATION TRANS	3041
INSTALLATION + CHECKOUT	3042
INITIAL SPARES	3043
INITIAL STOCKS	3044
COMPUTER PROGRAMS	3045
MISSION PROGRAM PRODUCTION	3046
UTIL + MAINT PROGRAM PROD	3047
PERSONNEL	3048
INITIAL TRAINING	3049
TRAVEL	3050
FACILITIES	3051
TOTAL INITIAL INVESTMENT	3052
OPERATIONS	
MISSION EQUIPMENT + AGE	3053
FOLLOW-ON SPARES	3054
EQUIPMENT REPLACEMENT	3055
SUBCONTRACTED MAINTENANCE	3056
COMMUNICATION + EQUIP RENTAL	3057
LEASED CIRCUITS	3058
TERMINAL EQUIPMENT	3059
OTHER EQUIPMENT	3060
COMPUTER PROGRAMS	3061
MAINTENANCE	3062
OPERATIONAL EXERCISES	3063
PERSONNEL	3064
PAY + ALLOWANCES	3065
ATTRITION TRAINING	3066
ATTRITION TRAVEL	3067
FACILITIES MAINT + OPERATION	3068
TOTAL OPERATIONS	3069

TABLE C
SUMMARY COST ESTIMATE BY BUDGET CODES

ELEMENT NAME	SEQ NO
RDT+E	
P100 AIRCRAFT PROCUREMENT	4001
P200 MISSILE PROCUREMENT	4002
P300 MILITARY CONSTRUCTION	4003
P400 OPERATION + MAINTENANCE	4004
P500 MILITARY PERSONNEL	4005
P600 RDT+E	4006
P800 OTHER PROCUREMENT	4007
TOTAL RDT+E	4008
INITIAL INVESTMENT	
P100 AIRCRAFT PROCUREMENT	4009
P200 MISSILE PROCUREMENT	4010
P300 MILITARY CONSTRUCTION	4011
P400 OPERATION + MAINTENANCE	4012
P500 MILITARY PERSONNEL	4013
P600 RDT+E	4014
P800 OTHER PROCUREMENT	4015
TOTAL INITIAL INVESTMENT	4016
OPERATIONS	
P100 AIRCRAFT PROCUREMENT	4017
P200 MISSILE PROCUREMENT	4018
P300 MILITARY CONSTRUCTION	4019
P400 OPERATION + MAINTENANCE	4020
P500 MILITARY PERSONNEL	4021
P600 RDT+E	4022
P800 OTHER PROCUREMENT	4023
TOTAL OPERATIONS	4024
TOTAL	
P100 AIRCRAFT PROCUREMENT	4025
P200 MISSILE PROCUREMENT	4026
P300 MILITARY CONSTRUCTION	4027
P400 OPERATION + MAINTENANCE	4028
P500 MILITARY PERSONNEL	4029
P600 RDT+E	4030
P800 OTHER PROCUREMENT	4031
GRAND TOTAL	4032

TABLE D
SUBSYSTEM COST ESTIMATE BY BUDGET CODES

ELEMENT NAME	SEQ NO
GENERAL SYSTEM	
P100 AIRCRAFT PROCUREMENT	4033
P200 MISSILE PROCUREMENT	4034
P300 MILITARY CONSTRUCTION	4035
P400 OPERATION + MAINTENANCE	4036
P500 MILITARY PERSONNEL	4037
P600 RDT+E	4038
P800 OTHER PROCUREMENT	4039
TOTAL GENERAL SYSTEM	4040
HARDWARE SUBSYSTEMS	
P100 AIRCRAFT PROCUREMENT	4041
P200 MISSILE PROCUREMENT	4042
P300 MILITARY CONSTRUCTION	4043
P400 OPERATION + MAINTENANCE	4044
P500 MILITARY PERSONNEL	4045
P600 RDT+E	4046
P800 OTHER PROCUREMENT	4047
TOTAL HARDWARE SUBSYSTEMS	4048
COMPUTER PROGRAMS	
P100 AIRCRAFT PROCUREMENT	4049
P200 MISSILE PROCUREMENT	4050
P300 MILITARY CONSTRUCTION	4051
P400 OPERATION + MAINTENANCE	4052
P500 MILITARY PERSONNEL	4053
P600 RDT+E	4054
P800 OTHER PROCUREMENT	4055
TOTAL COMPUTER PROGRAMS	4056
PERSONNEL	
P100 AIRCRAFT PROCUREMENT	4057
P200 MISSILE PROCUREMENT	4058
P300 MILITARY CONSTRUCTION	4059
P400 OPERATION + MAINTENANCE	4060
P500 MILITARY PERSONNEL	4061
P600 RDT+E	4062
P800 OTHER PROCUREMENT	4063
TOTAL PERSONNEL	4064
FACILITIES	
P100 AIRCRAFT PROCUREMENT	4065
P200 MISSILE PROCUREMENT	4066
P300 MILITARY CONSTRUCTION	4067
P400 OPERATION + MAINTENANCE	4068
P500 MILITARY PERSONNEL	4069
P600 RDT+E	4070
P800 OTHER PROCUREMENT	4071
TOTAL FACILITIES	4072

TABLE E

HARDWARE SUBSYSTEMS COST ESTIMATES BY BUDGET CODES

ELEMENT NAME	SEQ NO
DATA PROCESSING	
P100 AIRCRAFT PROCUREMENT	4073
P200 MISSILE PROCUREMENT	4074
P300 MILITARY CONSTRUCTION	4075
P400 OPERATION + MAINTENANCE	4076
P500 MILITARY PERSONNEL	4077
P600 RDT+E	4078
P800 OTHER PROCUREMENT	4079
TOTAL DATA PROCESSING	4080
DATA PRESENTATION	
P100 AIRCRAFT PROCUREMENT	4081
P200 MISSILE PROCUREMENT	4082
P300 MILITARY CONSTRUCTION	4083
P400 OPERATION + MAINTENANCE	4084
P500 MILITARY PERSONNEL	4085
P600 RDT+E	4086
P800 OTHER PROCUREMENT	4087
TOTAL DATA PRESENTATION	4088
COMMUNICATIONS	
P100 AIRCRAFT PROCUREMENT	4089
P200 MISSILE PROCUREMENT	4090
P300 MILITARY CONSTRUCTION	4091
P400 OPERATION + MAINTENANCE	4092
P500 MILITARY PERSONNEL	4093
P600 RDT+E	4094
P800 OTHER PROCUREMENT	4095
TOTAL COMMUNICATIONS	4096
DATA ACQUISITION	
P100 AIRCRAFT PROCUREMENT	4097
P200 MISSILE PROCUREMENT	4098
P300 MILITARY CONSTRUCTION	4099
P400 OPERATION + MAINTENANCE	4100
P500 MILITARY PERSONNEL	4101
P600 RDT+E	4102
P800 OTHER PROCUREMENT	4103
TOTAL DATA ACQUISITION	4104
AEROSPACE VEHICLES	
P100 AIRCRAFT PROCUREMENT	4105
P200 MISSILE PROCUREMENT	4106
P300 MILITARY CONSTRUCTION	4107
P400 OPERATION + MAINTENANCE	4108
P500 MILITARY PERSONNEL	4109
P600 RDT+E	4110
P800 OTHER PROCUREMENT	4111
TOTAL AEROSPACE VEHICLES	4112
TOTALS	
P100 AIRCRAFT PROCUREMENT	4113
P200 MISSILE PROCUREMENT	4114
P300 MILITARY CONSTRUCTION	4115
P400 OPERATION + MAINTENANCE	4116
P500 MILITARY PERSONNEL	4117
P600 RDT+E	4118
P800 OTHER PROCUREMENT	4119
TOTAL BUDGET CODES	4120

Appendix A
Exhibit 5

USED-ON TABLE

General System Subsystem #1

Reference Element	Elements Using Reference Elements 1	2	3	4
1001	1260*	3036	4038	
1002	1001	3018		
1003	1001	3033		
1004	1003	3034		
1005	1004			
1006	1004			
1007	1004			
1008	1004			
1009	1003	3035		
1010	1009			
1011	1009			
1012	1009			
1013	1009			
1014	1001	3019		
1015	1014			
1016	1014			

*Element 1260 is overall total of structure

Appendix A
Exhibit 5

USED-ON TABLE

Data Processing Subsystem #2

Reference Element	Elements Using Reference Elements 1	2	3	4	Reference Element	Elements Using Reference Elements 1	2	3	4
1017	1260	4079	4080		1034	1032			
1018	1017				1035	1017			
1019	1018	3021	4078		1036	1035	3021	4078	
1020	1019	3022			1037	1035			
1021	1019	3023			1038	1037	3039		
1022	1021				1039	1037	3040		
1023	1021				1040	1037	3041		
1024	1019	3024			1041	1037	3042	4012	4076
1025	1018				1042	1035	3043		
1026	1025	3038			1043	1017	4076		
1027	1026				1044	1043	3053		
1028	1026				1045	1044	3054		
1029	1025	3040			1046	1044	3054		
1030	1025	3041			1047	1044	3055		
1031	1025	3042	4012	4076	1048	1044	3056		
1032	1018	3043			1049	1043	3057	3060	
1033	1032								

Appendix A
Exhibit 5

USED-ON TABLE

Data Presentation Subsystem #3

Reference Element	Elements Using Reference Elements 1	2	3	4
1050	1260	4087	4088	
1051	1050			
1052	1051	3021	4086	
1053	1052	3022		
1054	1052	3023		
1055	1054			
1056	1054			
1057	1052	3024		
1058	1051			
1059	1058	3038		
1060	1059			
1061	1059			
1062	1058	3040		
1063	1058	3041		
1064	1058	3042	4012	4084
1065	1051	3043		
1066	1065			
1067	1065			
1068	1050			
1069	1068	3021	4086	
1070	1068			
1071	1070	3039		
1072	1070	3040		
1073	1070	3041		
1074	1070	3042	4012	4084
1075	1068	3043		
1076	1050	4084		
1077	1076	3053		
1078	1077	3054		
1079	1077	3054		
1080	1077	3055		
1081	1077	3056		
1082	1076	3057	3060	

Appendix A
Exhibit 5

USED-ON TABLE

Communications Subsystem #4

Reference Element	Element Using Reference Elements 1	2	3	4
1083	1260	4095	4096	
1084	1083			
1085	1084	3021	4094	
1086	1085	3022		
1087	1085	3023		
1088	1087			
1089	1087			
1090	1085	3024		
1091	1084			
1092	1091	3038		
1093	1092			
1094	1092			
1095	1091	3040		
1096	1091	3041		
1097	1091	3042	4012	4092
1098	1084	3043		
1099	1098			
1100	1098			
1101	1083			
1102	1101	3021	4094	
1103	1101			
1104	1103	3039		
1105	1103	3040		
1106	1103	3041		
1107	1103	3042	4012	4092
1108	1101	3043		
1109	1083	4092		
1110	1109	3053		
1111	1110	3054		
1112	1110	3054		
1113	1110	3055		
1114	1110	3056		
1115	1109	3057		
1116	1115	3058		
1117	1115	3059		

Appendix A
Exhibit 5

USED-ON TABLE

Data Acquisition Subsystem #5

Reference Element	Elements Using Reference Elements 1	2	3	4	Reference Element	Elements Using Reference Elements 1	2	3	4
1118	1260	4103	4104		1135	1133			
1119	1118				1136	1118			
1120	1119	3021	4102		1137	1136	3021	4102	
1121	1120	3022			1138	1136			
1122	1120	3023			1139	1138	3039		
1123	1122				1140	1138	3040		
1124	1122				1141	1138	3041		
1125	1120	3024			1142	1138	3042	4012	4100
1126	1119				1143	1136	3043		
1127	1126	3038			1144	1118	4100		
1128	1127				1145	1144	3053		
1129	1127				1146	1145	3054		
1130	1126	3040			1147	1145	3054		
1131	1126	3041			1148	1145	3055		
1132	1126	3042	4012	4100	1149	1145	3056		
1133	1119	3043			1150	1144	3057	3060	
1134	1133								

Appendix A
Exhibit 5

USED-ON TABLE

Aerospace Vehicles Subsystem #6

Reference Element	Elements Using Reference Elements 1	2	3	4	Reference Element	Elements Using Reference Elements 1	2	3	4
1151	1260	4105	4106	4112	1168	1166			
1152	1151				1169	1151			
1153	1152	3021	4110		1170	1169	3021	4110	
1154	1153	3022			1171	1169			
1155	1153	3023			1172	1171	3039		
1156	1155				1173	1171	3040		
1157	1155				1174	1171	3041		
1158	1153	3024			1175	1171	3042	4012	4108
1159	1152				1176	1169	3043		
1160	1159	3038			1177	1151	4108		
1161	1160				1178	1177	3053		
1162	1160				1179	1178	3054		
1163	1159	3040			1180	1178	3054		
1164	1159	3041			1181	1178	3055		
1165	1159	3042	4012	4108	1182	1178	3056		
1166	1152	3043			1183	1177	3057	3060	
1167	1166								

Appendix A
Exhibit 5

USED-ON TABLE

Computer Programs Subsystem #7

Reference Element	Elements Using Reference Elements			
	1	2	3	4
1184	1260	4055	4056	
1185	1184			
1186	1185	3026	4054	
1187	1186	3027		
1188	1186	3028		
1189	1186	3029		
1190	1185	3046		
1191	1190			
1192	1191			
1193	1191			
1194	1191			
1195	1190			
1196	1184			
1197	1196	3026	3030	4054
1198	1196	3047		
1199	1198			
1200	1198			
1201	1184	3061	4052	
1202	1201	3062		
1203	1201	3063		

Appendix A
Exhibit 5

USED-ON TABLE
Personnel Subsystem #8

Reference Element	Elements Using Reference Elements 1	2	3	4	Reference Element	Elements Using Reference Elements 1	2	3	4
1204	1260	4064			1222	1204	3064	4061	
1205	1204				1223	1222			
1206	1205	3031	4062		1224	1223	3065		
1207	1205	3048			1225	1223	3065		
1208	1207	3049	4063		1226	1223	3065	4060	
1209	1207	3049	4063		1227	1223	3066	4060	
1210	1207	3050	4013	4061	1228	1223	3067		
1211	1204				1229	1222			
1212	1211				1230	1229	3065		
1213	1212	3031	4062		1231	1229	3065		
1214	1212	3048			1232	1229	3065	4060	
1215	1214	3049	4063		1233	1229	3066	4060	
1216	1214	3050	4013	4061	1234	1229	3067		
1217	1211				1235	1222			
1218	1217	3031	4062		1236	1235	3065		
1219	1217	3048			1237	1235	3065		
1220	1219	3049	4063		1238	1235	3065	4060	
1221	1219	3050	4013	4061	1239	1235	3066	4060	
					1240	1235	3067		

USED-ON TABLE

Facilities & Support Subsystem #9

Reference Element	Elements Using Reference Elements 1	2	3	4
1241	1260	4072		
1242	1241	4067		
1243	1242	3032	4003	
1244	1242	3051	4011	
1245	1244			
1246	1244			
1247	1244			
1248	1244			
1249	1241	3041	4071	
1250	1241	3044	4071	
1251	1241	3068	4068	
1252	1251			
1253	1252			
1254	1252			
1255	1252			
1256	1252			
1257	1252			
1258	1252			
1259	1251			

Appendix A
Exhibit 5

USED-ON TABLE

Table A

Reference Element	Elements Using Reference Elements 1	2	3	4
3001				
3002				
3003				
3004	3017			
3005				
3006				
3007				
3008				
3009				
3010	3017			
3011				
3012				
3013				
3014				
3015				
3016	3017			
3017				

USED-ON TABLE
Table B

Reference Element	Elements Using Reference Elements 1	2
3018	3001	
3019	3001	
3020	3002	
3021	3025	3020
3022	3025	
3023	3025	
3024	3025	
3025		
3026	3020	
3027		
3028		
3029		
3030		
3031	3020	
3032	3020	
3033	3003	
3034		
3035		
3036	3004	
3037	3005	3052
3038	3037	
3039	3037	
3040	3037	
3041	3037	
3042	3037	
3043	3006	3052
3044	3006	3052
3045	3007	3052
3046		
3047		
3048	3008	3052
3049		
3050		
3051	3009	3052
3052	3010	
3053	3011	3069
3054		
3055		
3056		
3057	3013	3069
3058		
3059		
3060		
3061	3012	3069
3062		
3063		
3064	3014	3069
3065		
3066		
3067		
3068	3015	3069
3069	3016	

USED-ON TABLE
Table C

Reference Element	Elements Using Reference Elements 1	2	3	4
4001				
4002				
4003	4027	4008		
4004				
4005				
4006	4030	4008		
4007				
4008	4032			
4009	4025	4016		
4010	4026	4016		
4011	4016	4027		
4012	4016	4028	4020	
4013	4016	4029	4021	
4014				
4015	4031	4016		
4016	4032			
4017				
4018				
4019				
4020	4024	4028		
4021	4029	4024		
4022				
4023				
4024	4032			
4025				
4026				
4027				
4028				
4029				
4030				
4031				
4032				

USED-ON TABLE

Table D

Reference Element	Elements Using Reference Elements 1	2
4033		
4034		
4035		
4036		
4037		
4038	4040	4006
4039		
4040		
4041	4009	
4042	4010	
4043		
4044	4020	
4045		
4046	4006	
4047	4015	
4048		
4049		
4050		
4051		
4052	4020	4055

Reference Element	Elements Using Reference Elements 1	2
4053		
4054	4055	4006
4055	4015	
4056		
4057		
4058		
4059		
4060	4061	4020
4061	4021	
4062	4006	
4063	4015	
4064		
4065		
4066		
4067		
4068	4020	
4069		
4070		
4071	4015	
4072		

Appendix A
Exhibit 5

USED-ON TABLE

Table E

Reference Element	Elements Using Reference Elements 1	2	Reference Element	Elements Using Reference Elements 1	2
4073			4097		
4074			4098		
4075			4099		
4076	4079	4116	4100	4103	4116
4077			4101		
4078	4079	4118	4102	4103	4118
4079	4119		4103	4119	
4080			4104		
4081			4105	4113	
4082			4106	4114	
4083			4107		
4084	4087	4116	4108	4105	4116
4085			4109		
4086	4087	4118	4110	4105	4118
4087	4119		4111		
4088			4112		
4089			4113	4041	4120
4090			4114	4042	4120
4091			4115		
4092	4095	4116	4116	4044	4120
4093			4117		
4094	4095	4118	4118	4046	4120
4095	4119		4119	4047	4120
4096			4120	4048	